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NATIONAL DAM SAFETY PROGRAM. NEW LA BELLE LAKE DAM (MO-10372). --ETC(U)
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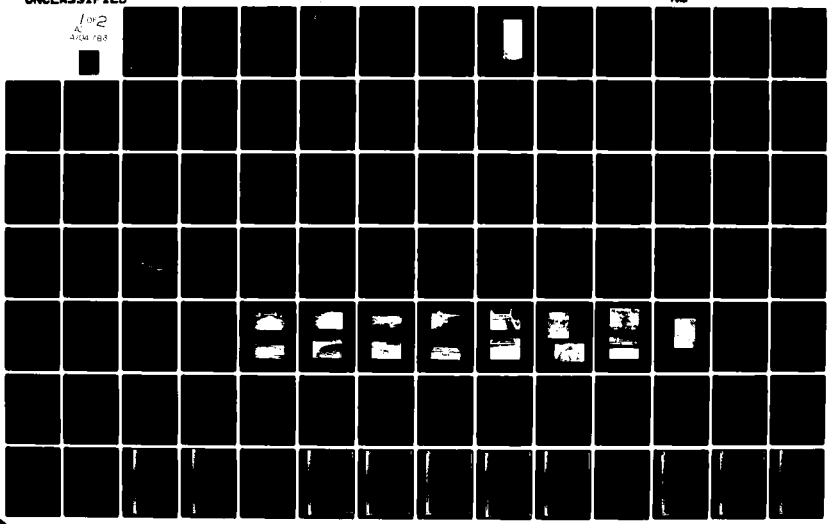

LEVEL II

MISSISSIPPI - SALT - QUINCY RIVER BASIN

AD A104783

NEW LA BELLE LAKE DAM
LEWIS COUNTY, MISSOURI
MO 10372

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

New La Belle Lake Dam (MO-10372), Mississippi - Salt - Quincy River Basin. Lewis County, Missouri. Phase I Inspection Report.

Final rept.
11 Dec 78

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PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: New Labelle Lake Dam (Mo. 10372),
Phase I Inspection Report

This report presents the results of field inspection and evaluation of New Labelle Lake Dam (Mo. 10372). It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED — 12 JAN 1979
Chief, Engineering Division — (Date)

APPROVED BY: SIGNED — 13 JAN 19..
Colonel, CE, District Engineer — (Date)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	New Labelle Lake Dam, Missouri Inv. No. 10372
State Located:	Missouri
County Located:	Lewis
Stream:	Unnamed Tributary of Troublesome Creek
Date of Inspection:	September 27 and October 6, 1978

New Labelle Lake Dam No. Mo.10372 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Two houses and a city water treatment plant would be subjected to flooding, with possible damage and/or destruction, and possible loss of life. New Labelle Lake Dam is in the small size classification since it is less than 40 feet high and impounds less than 1,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of New Labelle Lake Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. New Labelle Lake Dam is a small size dam with a high hazard

potential required by the guidelines to pass from one-half Probable Maximum Flood to the Probable Maximum Flood without overtopping. Since there is significant hazard potential downstream of the dam, the appropriate spillway design flood for this dam is a flood somewhat greater than one-half of the Probable Maximum Flood. It was determined that the spillway will pass 93 percent of the Probable Maximum Flood without overtopping the dam. ~~Our evaluation indicates that~~ the spillway will pass the 100-year flood, that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Deficiencies noted by the inspection team were a need for an annual inspection by a qualified professional engineer; lack of a maintenance schedule; required repairs to the service spillway structure, pipe and discharge channel; tree growth on the upstream embankment slope; and the buried discharge end of the reservoir drain line. The lack of stability and seepage analysis on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

NEW LABELLE LAKE DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

New Labelle Lake Dam, I.D. No. 10372

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NATIONAL DAM SAFETY PROGRAM

NEW LABELLE LAKE DAM, Missouri Inv. No. 10372

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for the New Labelle Lake Dam was carried out under Contract DACW 43-78-C-0160 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associated Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of the New Labelle Lake Dam was made on September 27, and October 6, 1978. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to east abutment or side, and right to the west abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The dam is a zoned embankment earthfill structure. The crest of the embankment has a width of 15 feet, and a length of 950 feet. The crest elevation is set at 696.0 feet above MSL, with the maximum height of the embankment 37 feet

above the minimum streambed elevation. The crest of the dam from station 4+27.8 to station 7+54.72 is in a curved shape, with a radius of curvature equal to 220.38 feet.

The upstream slope of the typical embankment section is constructed with a 1V to 3H side slope to elevation 685.5, a 5-foot wide berm at elevation 685.5, and a 1V to 3H slope to the ground surface.

An 18-inch layer of dumped rock riprap underlain by a 6-inch layer of pit run gravel was placed on the upstream slope for protection between elevation 685.5 and 691.0. The rocks used for the riprap were angular blocks of limestone up to 1 foot in diameter, with the typical size 4 to 10 inches in diameter. The crest and downstream slope of the embankment section is protected with vegetative cover.

The embankment section contains a central core of "Class 1" fill, and outside shells of "Class 2" fill. No information concerning the properties of the materials used for the embankment is available. The central core starts at crest elevation 694.0, with a width of 10 feet, and has side slopes of 1V to 1H.

Bedrock within the vicinity is composed of Mississippian age limestones. No rock crops out over the site. The soil in the vicinity of the dam is likely a Lindley silt loam, which is glacial in origin.

A cut-off trench, with side slopes of 1V to 1-1/2H, and a base width of 10 feet, was excavated into the foundation for a depth of 5 feet through abutments and up to 15 feet in the channel section.

There are two spillways for the New Labelle Lake reservoir. The service spillway is located near the mid-section of the dam embankment. This spillway consists of an uncontrolled concrete drop box inlet structure, currently at elevation 690.0 feet, which connects to a 30 inch C.M.P. discharge pipe at elevation 685.5. The discharge pipe extends from the inlet structure for about 64'-6" at a slope of approximately 3 percent, then slopes at 1V to 2-1/2H for 61'-6". The pipe then returns to a horizontal gradient for 39'-0" at an exit elevation of 660.0 into a trapezoidal grass-lined channel.

The emergency spillway is a grass-lined open channel located at the left abutment of the dam. The spillway crest has a bottom width of about 20 feet and side slopes of 1V to 3H. The spillway crest is at elevation 691.0 MSL. The spillway discharge channel is also grass-lined, which runs almost parallel to the embankment toe until it joins the service spillway discharge channel. There is a 24-inch C.M.P. under the county road at the junction of the service spillway discharge channel and the emergency spillway channel.

A municipal water treatment plant for the town of Labelle is situated approximately 200 feet below the downstream toe of the dam. The treatment plant provides for chemical treatment, settling, and filtering of the water supply. Pumps in the plant deliver the water through a pipeline to storage facilities at Labelle. Raw water from the reservoir is fed into the plant by gravity flow.

The raw water line consists of an 8-inch diameter cast iron pipe which connects at its upstream end with and 8-inch diameter flexible hose fitted with an intake strainer. The strainer is suspended by a galvanized wire rope connected

to a hand hoist which is mounted on the service spillway intake structure on the dam crest. The degree of submergence of the intake strainer can be adjusted by the hoist. The wire rope is carried over and suspended from a rope sheave attached to the end of a structural steel strut which projects out from the dam to a point above the strainer.

The design drawings indicate that the reach of the waterline under the dam embankment is encased in a 15 inch by 14 gage corrugated metal pipe.

Immediately downstream of the dam toe, an 8-inch drain line with a gate valve branches from the raw water line and leads to the watercourse draining from the downstream area of the dam.

The reservoir surface area is about 20 acres at the service spillway crest. A sediment channel exists at the upper end of the reservoir.

b. Location

The New Labelle Lake Dam is located on an unnamed tributary of Troublesome Creek, Lewis County, Missouri. The nearest downstream community is Steffenville, Missouri, approximately 11 miles downstream from the dam. The dam and reservoir are shown on Labelle Quadrangle Sheet (7.5 minute series) in Section 16, Township 61 North, Range 9 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Small" since its storage is less than 1,000 acre-feet. The dam is also classified as "Small" in dam size category becauses its height is less than 40 feet. The overall size classification is, accordingly, "Small" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. The estimated damage zone extends three miles downstream of the dam. Within the damage zone are two houses and a city water treatment plant. Also within the damage zone are one state highway and one county road. The floodplann is farmed.

e. Ownership

New Labelle Lake Dam is owned by the City of Labelle, located in Lewis County, Missouri.

f. Purpose of Dam

The purpose of the dam is to impound water for water supply system operated by the City of Labelle. The impounded water is released by means of the bottom outlet for subsequent use in the city by way of a pumping station immedi-

ately downstream from the dam. The reservoir is also for recreational use.

g. Design and Construction History

The dam was designed in 1959 by Wm. Klingner Engineers of Quincy, Illinois. Construction was completed in 1961 by Hardy and Sons Construction of Shellbyville, Missouri.

The only post construction work on the dam and appurtenant structures has been the addition of 2 feet to the top of the drop box inlet structure for the service spillway.

h. Normal Operational Procedures

The dam is used to impound water for use as water supply for the City of Labelle, Missouri. The reservoir level is controlled by rainfall, runoff, evaporation, and the water supply requirements of the city. The reservoir is likely close to full at all times.

1.3 Pertinent Data

a. Drainage Area	176 acres
b. Discharge at Damsite	All discharge at the damsite is through two uncontrolled spillways and a water supply outlet
Estimated experienced maximum flood:	600 cfs
Estimated ungated spillway capacity at maximum pool elevation:	1,200 cfs (W.S. at 696.0)

c. Elevation (Feet above MSL)

Top of dam:		696.0
Spillway crest:	(Service spillway)	690.0
	(Emergency spillway)	691.0
Minimum streambed elevation at centerline of dam:		659.0
Maximum tailwater:		Unknown

d. Reservoir

Length of maximum pool:	1,800 feet ±

e. Storage (Acre-Feet)

Top of dam:	339
Spillway crest (Service Spillway):	194

f. Reservoir Surface (Acres)

Top of dam:	30
Spillway crest: (Service spillway)	17

g. Dam

Type:	Zoned earthfill embankment
Length:	950 feet
Height (maximum):	37 feet
Top width:	15 feet
Side slopes:	
Downstream	1V to 3H
Upstream	1V to 2-1/2H
Zoning:	Central core and outer shells
Impervious core:	Central core has a crest width at elevation 694.0 and 1V to 1H side slopes
Cutoff:	Core trench with 10-foot bottom width and 1V to 1-1/2H side slopes
Grout curtain:	None

h. Diversion and Regulating Tunnel — None

i. Spillway

Type:	(Service spillway)	Uncontrolled, 30-inch diameter C.M.P.
	(Emergency spillway)	Uncontrolled
Length of weir:	(Service spillway)	16 feet
	(Emerg. spillway)	20 feet
Crest Elevation:	(Service spillway)	690 feet MSL
	(Emergency spillway)	691 feet MSL

j. Regulating Outlets

Type:	8-inch diameter cast iron pipe
Length:	350 feet
Closure:	8-inch diameter gate valve
Maximum Capacity:	5.2 cfs

SECTION 2: ENGINEERING DATA

2.1 Design

Original design drawings are available for the dam and appurtenant structures. These drawings were made in 1959, and some are given as plates in this report. The design drawings are available from Klingner Engineering, 310 Broadway Street, Quincy, Illinois.

2.2 Construction

The dam was constructed in 1959 and 1960. In 1971, 2 feet was added to the drop box inlet structure for the service spillway to increase the storage to elevation 690.0. An 8-inch thick wall has also been constructed inside of the drop box structure. No additional construction data is available.

2.3 Operation

No operation records for New Labelle Lake Dam are available.

A seep has been detected 1 to 2 vertical feet below the berm on the line of the corrugated metal pipe for the service spillway. This seep was originally detected about 8 years ago, but corrective measures have not been taken.

2.4 Evaluation

a. Availability

The only available data for this project is the original design drawings. No construction data or operation data is available.

In addition, no pertinent data was available for review on hydrology, spillway capacity, flood routing through the reservoir, outlet capacity, slope stability or seepage analysis.

b. Adequacy

The design drawings are adequate to aid in evaluating the adequacy of the hydraulic and hydrologic capabilities and stability of the dam for Phase I investigations.

The lack of engineering data, other than design drawings did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be asssessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection with the aid of available design drawings, past performance history, and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

The dam and appurtenant structures appear to have been constructed in accordance with the available design drawings. However, the modification to the drop box inlet structure is not shown on the design drawings.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of New Labelle Lake Dam was made on September 27, and October 6, 1978. The following persons were present during the inspection:

Name	Affiliation	Discipline
Yin Au-Yeung	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
David Bramwell	Engineering Consultants, Inc.	Geology
Jon Diebel	Engineering Consultants, Inc.	Soils
John Ismert	Engineering Consultants, Inc.	Mechanical
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil & Structural

Specific observations are discussed below.

b. Dam

The crest of the dam has a heavy vegetative cover which adequately protects the embankment material. The crest of the dam near the section of the service spillway pipe appears to have settled several feet. This could be observed best from across the paved road to the right of the dam, but the high grass on the embankment crest makes observing the condition very difficult. The local dam superintendent stated that the settlement could be easily observed following cutting of the grass on the crest.

The upstream embankment slope did not exhibit significant sloughing of the embankment material. The riprap, which was placed originally to elevation 691.0, is only 1 foot above the maximum water surface elevation following the reconstruction of the drop inlet structure. However, the heavy grass on the upstream slope is adequately protecting the embankment. Some small trees were observed growing on the upstream embankment slope during the inspection.

The downstream slope is generally well-protected by the vegetative cover. An area was observed on the downstream embankment slope where water appears to flow through the embankment material. The location of this area is approximately 2 vertical feet below the berm on the alignment of the corrugated metal pipe service spillway. A conversation with the dam superintendent indicated that the leak originated approximately 8 years ago. Five years ago a high chlorine solution was injected into the C.M.P. at the upstream end, and a chlorine detector was used to test the water flowing from the embankment. It was found that the seepage flow showed a high chlorine concentration almost immediately, indicating that the water flow from the embankment was the same water injected into the C.M.P. It can, therefore, be concluded that the water flow from the embankment is caused by leakage in the C.M.P. This conclusion is substantiated by the fact that the flow only occurs if water is flowing in the C.M.P. No flow was seen during the day of inspection.

c. Appurtenant Structures

(1) Spillways

The concrete drop inlet structure is in a deteriorated condition. Several major vertical cracks, minor erosion and moderate spalling on the concrete were observed.

There are small trees growing on the upstream slope of the dam near the spillway intake entrance.

The emergency spillway is well-defined, adequately maintained and in a good condition.

Capacity of the 24-inch C.M.P. culvert under the unpaved county road is inadequate for passing the discharge from the spillways without overtopping the road.

The downstream channel leading to the 24-inch C.M.P. is covered with thick grass.

(2) Outlet Works

A cursory inspection was made of the water treatment plant. The plant was clean and in good operating condition. Except for routine maintenance tasks, it is designed to operate unattended.

The sizes, material, and condition of the raw water outlet and drain line under the dam could not be confirmed since they are buried and not accessible for inspection. This includes the discharge end of the

8-inch drain line which is shown to discharge in the spillway discharge channel, and the gate valve controlling this drain line.

d. Reservoir Area

The water level in the reservoir was 688.5 on the day of the inspection. No indication of instability or severe erosion along the rim was apparent. At present, no development has occurred along the shoreline.

e. Downstream Channel

Spillway discharge from the service spillway flows into an unlined trapezoidal channel which was covered with thick grass at the time of inspection. The discharge channel is connected with a 24-inch C.M.P. culvert, approximately 150 feet downstream from the 30-inch C.M.P. exit. Spillway discharge from the emergency spillway also joins at this point. Due to the smaller capacity of the 24-inch culvert, as compared to the spillways capacities, overtopping of the unpaved county road is unavoidable whenever the spillway discharge exceeds the capacity of the 24-inch culvert pipe.

3.2 Evaluation

The visual inspection revealed several items which should be repaired within a reasonable time. However, the location on the downstream embankment slope exhibiting water flow, coupled with the apparent settlement of the embankment in this section, is a condition which indicates a potential serious problem, and should be investigated as soon as possible.

Other items which indicated the need for remedial measures within a reasonable period of time include:

1. The deteriorated concrete drop inlet structure.

2. The small trees growing on the upstream embankment slope.

3. The downstream discharge channel of the service spillway exhibiting heavy vegetative growth, preventing proper flow away from the dam.

4. The inability of the downstream discharge channel and the 24-inch C.M.P. to take the capacity of both spillways without submerging the toe of the dam.

5. The buried valve and discharge end of the reservoir drain line.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

New Labelle Lake Dam is used to impound water from an unnamed tributary of Troublesome Creek for use as water supply for the City of Labelle, Missouri. The water superintendent lives in close proximity to the dam and reservoir, and monitors the lake and treatment plant daily.

The only operating facility the the damsite is the raw water supply intake and appurtenant piping. The intake for the water supply is a flexible hose fitted with a strainer. Downstream of the dam an 8-inch drain line branches from the raw water line.

The valve for controlling the flow through the branch drain line is manually operated, and should normally be kept closed. The drain valve would be opened to drain the reservoir for dam or spillway maintenance, or in event of an emergency situation.

4.2 Maintenance of Dam

The dam is maintained by the Labelle Water Superintendent. Maintenance for the dam appears to be adequate. The small trees beginning to grow on the upstream slope should be cut before they become a hazard.

4.3 Maintenance of Operating Facilities

The discharge end of the reservoir drain line is apparently buried, and should be uncovered. A cursory inspection of the water treatment plant showed the plant to be clean and in good operating condition.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system for this dam.

4.5 Evaluation

The operation procedures and maintenance program at the dam and appurtenant structures appears to be satisfactory. Necessary maintenance includes uncovering the discharge end of the drain line and cutting of trees on the upstream embankment slope.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

New Labelle Lake is located near the western edge of Lewis County, Missouri, in the northeast corner of the state. The main access to the Labelle Lake from the city of Labelle, Missouri is south on State Road D for 1.3 miles. The reservoir is on the east side of Route D next to the Labelle pumping station.

The watershed area for the New Labelle Lake encompasses approximately 176 acres with a minimal amount of forest and wooded area. The reservoir is located on a tributary of Troublesome Creek. Land gradient for the watershed area average about 3 to 4 percent.

Elevations within the watershed range from approximately 685 feet above MSL at the damsite to over 725 feet above MSL in the upper portion of the watershed.

A drainage map showing the watershed area is included in Appendix B.

Evaluation of the hydraulic and hydrologic features of New Labelle Lake Dam was based on criteria set forth in the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum

Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM 1110-2-1411 (Standard Project Storm). The SCS triangular hydrograph, transformed to a curvilinear hydrograph, was adopted for developing the unit hydrograph. The derived unit hydrograph is presented in Appendix B.

Initial and infiltration loss rates were applied to the PMP to obtain rainfall excesses. The rainfall excesses were then applied to the unit hydrograph to obtain the PMF hydrograph, utilizing the Corps of Engineers' computer program HEC-1, (Dam Safety Version), which was prepared specifically for dam safety analysis. The computed peak discharge of the PMF and one-half of the PMF are 3,615 cfs and 1,807 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method, also utilizing the HEC-1 (Dam Safety Version) computer program. The peak outflow discharges for the PMF and one-half of the PMF are 1,571 cfs and 532 cfs, respectively. Only the PMF, when routed through the reservoir, resulted in overtopping of the dam. The capacity of the emergency spillway is 1,070 cfs, with the water surface at the dam crest.

The stage-outflow relation for the spillways were prepared from field notes, sketches and limited construction drawings. The reservoir stage-capacity data were based on the U.S.G.S. Labelle Quadrangle (7.5 minute series) topographic maps (dated 1975) in combination with data given in the National Dam Safety Inventory Table. Reservoir storage capacity included surcharge levels exceeding the top of the

dam, and the spillways and overtop rating curve assumed that the dam remains intact during routing. In the routing computations, the discharge through the outlet facilities was excluded due to its insignificant magnitude as compared to the spillways discharge and the PMF. The combined spillways and overtop rating curve and the reservoir capacity curve are also presented in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam aims at avoiding overtopping. Overtopping is especially dangerous for an earth dam because the downrush of waters over the crest will erode the dam face and, if continued long enough, will breach the dam embankment and release all the stored water suddenly into the downstream floodplain. The safe hydrologic design of a dam calls for a spillway discharge capability, in combination with an embankment crest height that can handle a very large and exceedingly rare flood without overtopping.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to the owner, the maximum reservoir level was never higher than the crest of the embankment, and only once did the water flow over the emergency spillway.

c. Visual Observations

The service spillway intake structure is deteriorating. Vertical cracks, minor erosion and moderate spalling on the concrete were apparent. There are no energy dissipators of any kind downstream from the spillway pipe exit. The downstream channel, particularly the 24-inch C.M.P. culvert

under the county road, is not capable of passing the spillway discharge without overtopping the road. The channel is well-defined, but with no riprap protection. Grass growth in the channel is thick and tall. The emergency spillway is in good condition. However, this spillway merges with the service spillway discharge channel 175 feet downstream from the maximum section of the dam. In case the total spillway release is larger than the 24-inch culvert, water would probably submerge the embankment toe, thus, adversely affecting the strutural integrity of the dam.

A sedimentation channel was observed several hundred feet north of the right abutment.

The original design called for a pumping system to bring water from Troublesome Creek up to the sedimentation channel and, eventually, to the lake. The pumps at Troublesome Creek were never installed, but the sedimentation channel was constructed, regardless.

d. Overtopping Potential

As indicated in Section 5.1-a., only the Probable Maximum Flood, when routed through the reservoir, results in overtopping of the dam. The PMF overtopped the dam crest by 0.18 feet. The total duration of embankment overflow is 0.33 hours. The settlement of the embankment was not great enough to be considered in the overtopping calculation. The spillways of New Labelle Lake Dam are capable of passing a flood equal to approximately 93 percent of the PMF just before overtopping the dam. The 100-year flood is equal to approximately 10 percent of the PMF, therefore, the spillway will pass the 100-year flood without overtopping of the dam.

The effect from rupture of the dam could extend approximately three miles downstream of the dam. Immediately downstream there are two houses and a city water treatment plant. Also within this zone are one state highway and one county road. The floodplain is farmed.

SECTION 6: STRUCTURAL STABILITY

6.1 Structural Stability

a. Visual Observations

The apparent settlement of the maximum section of the dam embankment along the alignment of the C.M.P. spillway indicates a potentially hazardous condition. Possibly related to this settlement is the water breaking out on the downstream slope from leakage of the C.M.P. It is highly possible that these two observations are related, with the embankment settlement either the cause or the result of the leakage through the C.M.P.

The service spillway drop inlet structure should be repaired to prevent continuous flow through the pipe. This condition is especially critical due to the likely leakage in the C.M.P. pipe and the poor condition of the service spillway discharge channel.

The route of spillways discharges is incapable of carrying potential flows without submerging the toe of the dam. This is a condition which should be corrected. Such submergence may seriously influence the stability of the structure.

The buried discharge end of the reservoir drain is a condition which should be repaired.

b. Design and Construction Data

No design or construction data relating to the structural stability of the dam were found. No design data relating to seepage and stability analysis are known to exist.

c. Operating Records

No operating records are available relating to the stability of the dam. The water level on the day of the inspection was 1.5 feet below the service spillway crest, which is .5 feet above the high water level shown on the design drawings. It is not certain whether the additional 2 feet of water now allowed in the reservoir was accounted for in the original design, but the dam has apparently functioned satisfactorily with the additional water in the reservoir.

d. Post Construction Changes

The original plans show an elevation of 688.0 for the crest of the service spillway. Two feet has been added to the top of the drop box inlet structure to increase the storage of the reservoir. The elevation of the top of the spillway is now 690.0. The elevation of the emergency spillway remains at 691.0 as on the original plans. No other post construction changes were apparent.

e. Seismic Stability

In general, projects which are located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist.

New Labelle Lake Dam is located in Seismic Zone 1. A detailed seismic analysis is not felt to be necessary for this embankment.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity was found to be satisfactory to pass 93 percent of the Probable Maximum Flood.

The apparent settlement of the dam embankment along the alignment of the corrugated metal pipe utilized for the service spillway, coupled with the apparent leakage of the pipe, is a potentially hazardous condition which should be investigated. It is possible that either embankment settle-

ment caused misalignment of the corrugated metal pipe, resulting in a leak, or that the leak developed first and the embankment settlement was caused by saturation of the embankment materials.

The poor condition of the service spillway upstream and downstream ends magnifies the problem. The drop inlet structure is in a deteriorated condition, with the joints between the drop box and headwall allowing flow into the C.M.P. pipe, and since the C.M.P. leaks, water is continuously allowed into the embankment materials. The downstream discharge channel of the service spillway is full of vegetative growth, not allowing even small discharges to adequately drain from the downstream toe of the embankment. Large discharges would be constrained by the 24-inch C.M.P. culvert under the road as well. Discharges from the emergency spillway would flow along the toe of the dam and into this discharge channel, which will compound the drainage problem. Due to the number and relationships of the various problems associated with the service spillway, it is recommended that a complete engineering study be performed to find the most satisfactory and economical solution.

Other items observed during the visual inspection which should be repaired within a reasonable period of time are the trees beginning to grow on the upstream embankment slope, and the buried discharge end of the reservoir drain line.

b. Adequacy of Information

Information concerning operation and maintenance of the dam and appurtenant structures is somewhat lacking. It is recommended that the following programs be initiated to help alleviate this problem:

1. Annual inspection of the dam by a professional engineer experienced in the design and construction of earthen dams should be made and this inspection report made a matter of record.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams".

The design drawings, together with performance history and visual inspection findings is felt to be adequate information to support the conclusions presented in this report.

c. Urgency

The engineering study suggested in the previous section should be accomplished as soon as soon as possible. Other remedial measures should be accomplished during routine maintenance.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

The engineering study previously recommended should address various alternatives to find the best solution to the problem.

b. O & M Maintenance Procedures

The owner should initiate the following programs:

1. Annual inspection of the dam by a professional engineer experienced in the design and construction of earth dams.

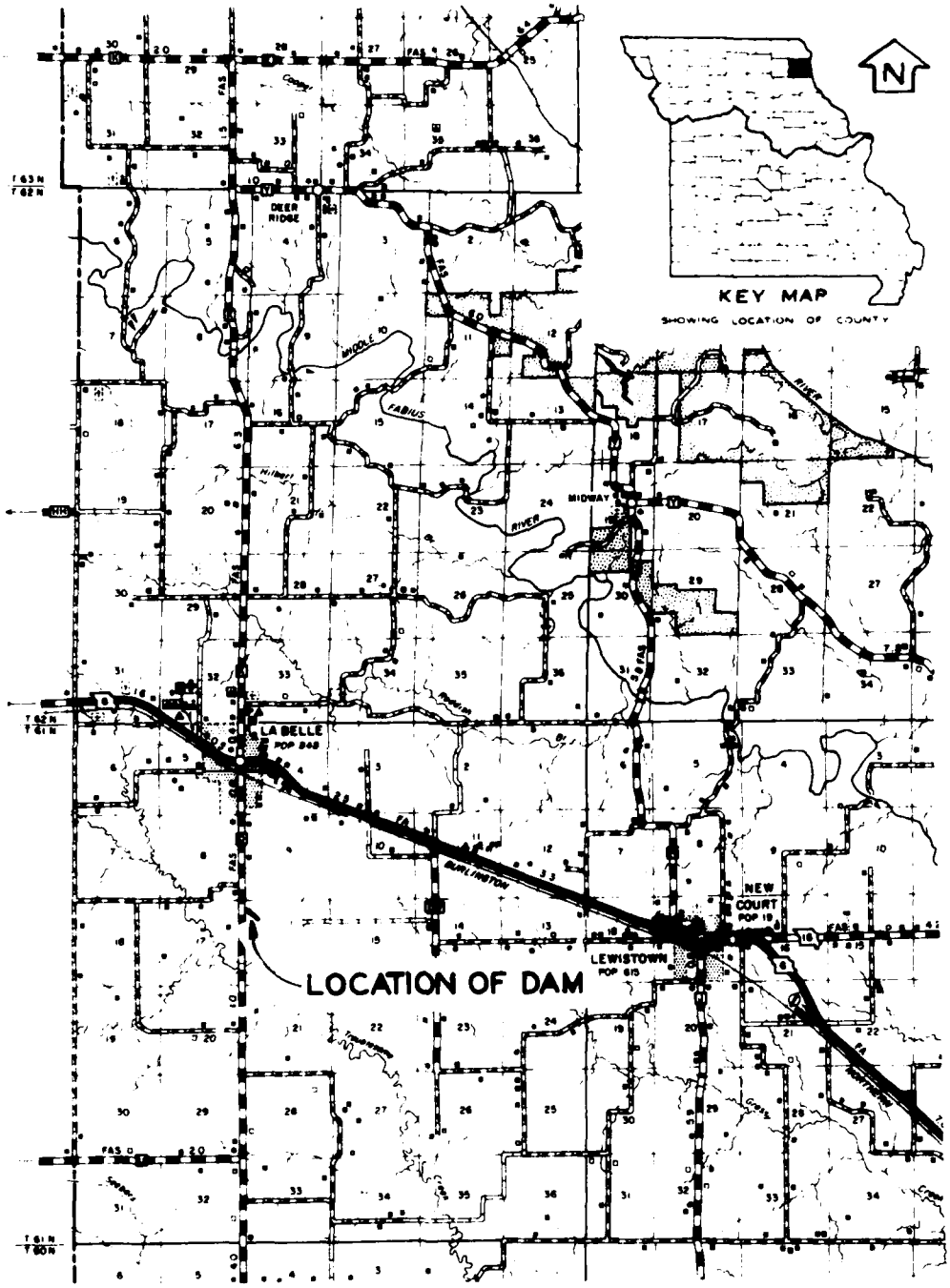
2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Cut all trees on the upstream embankment slope and prevent future growth.

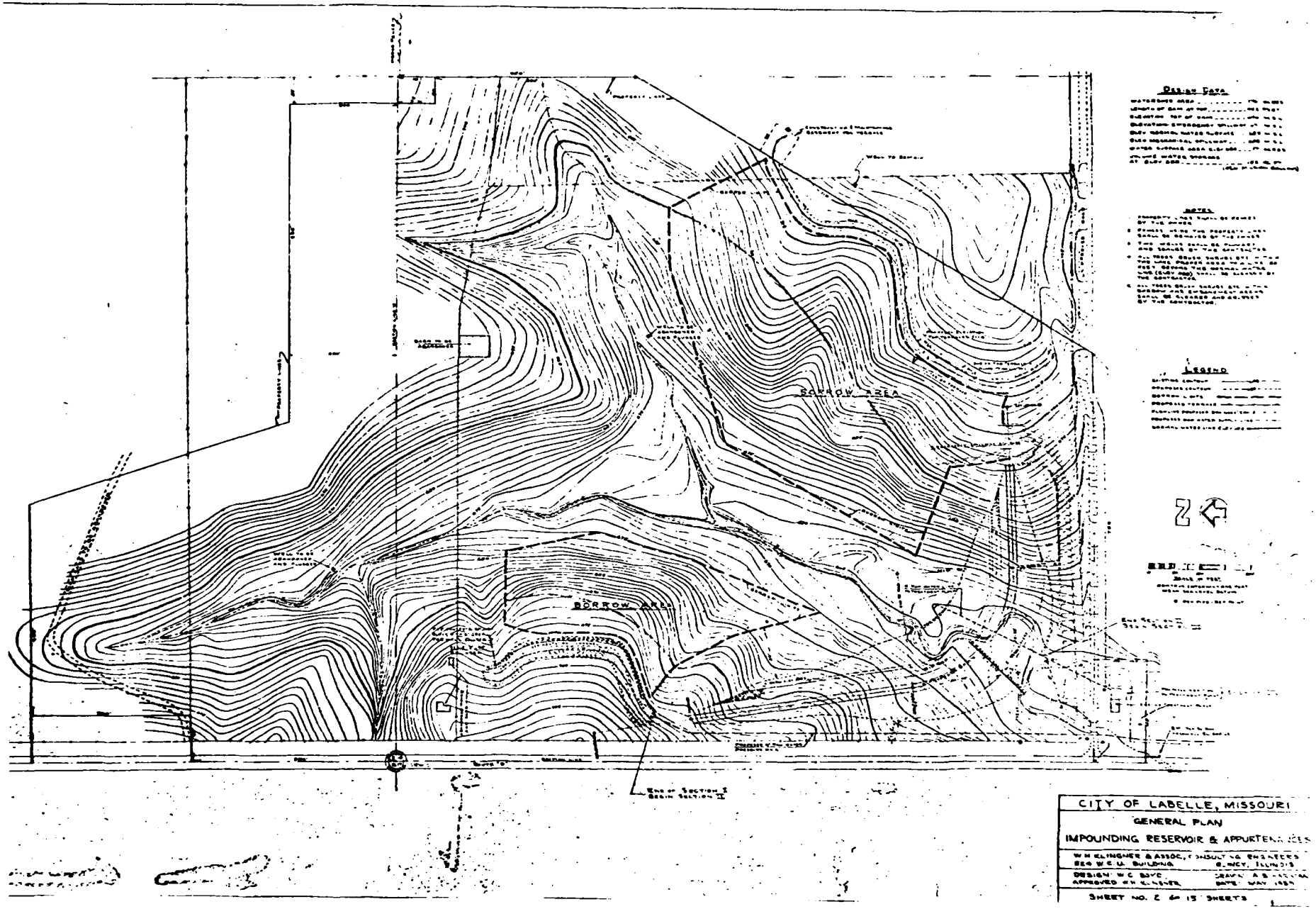
4. Uncover the valve operator and discharge end of the reservoir drain line.

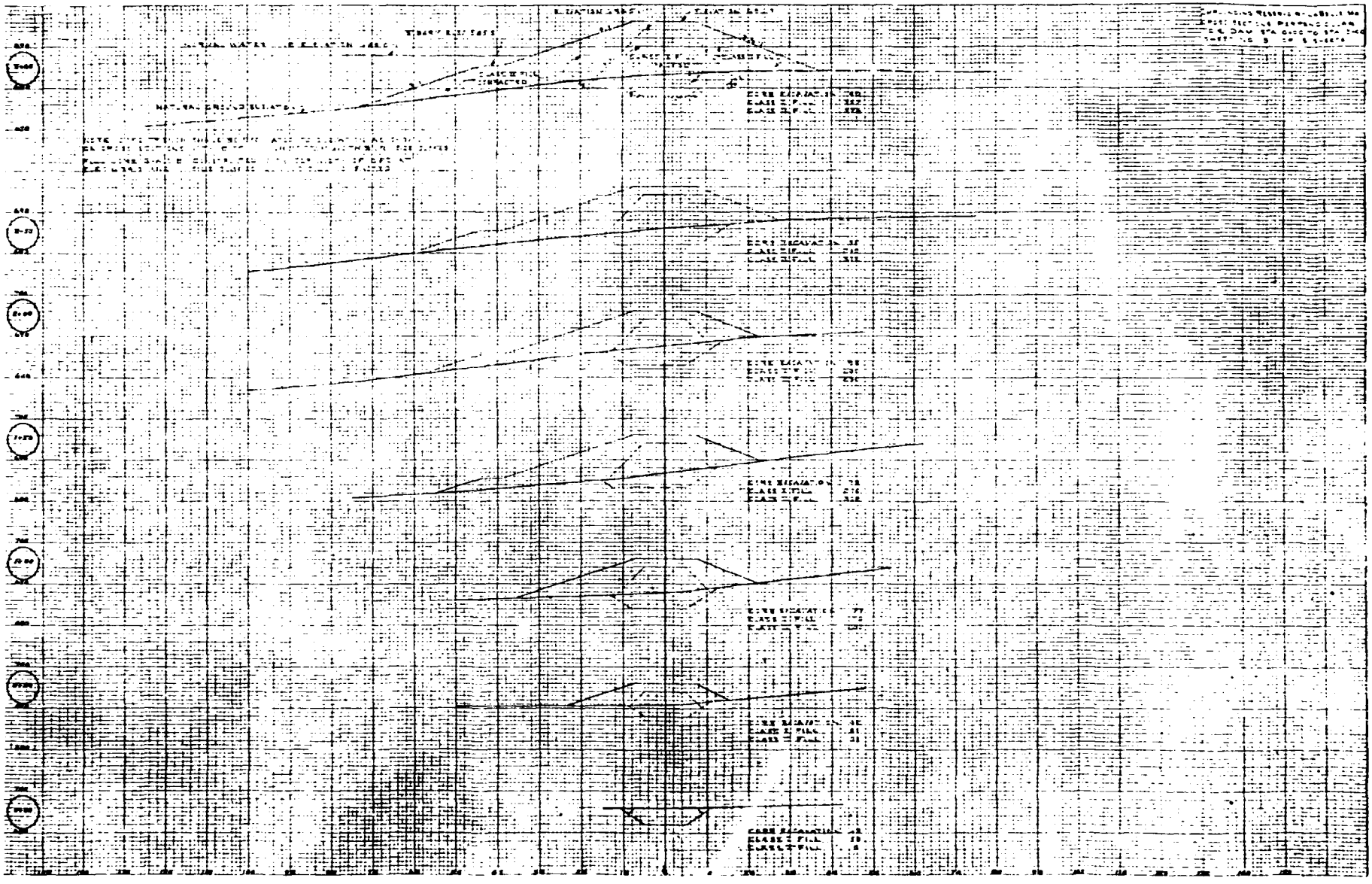
5. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

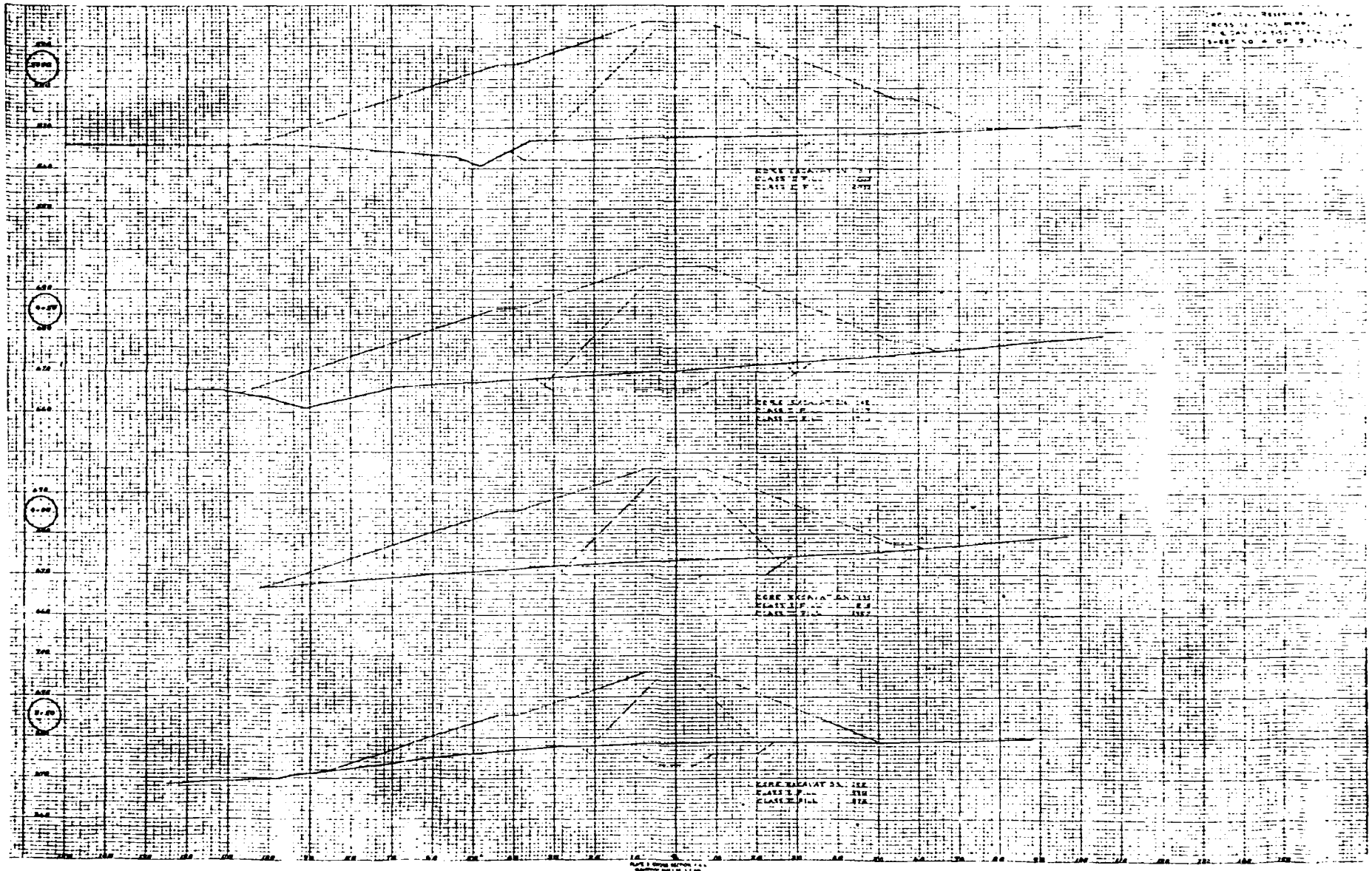
PLATES

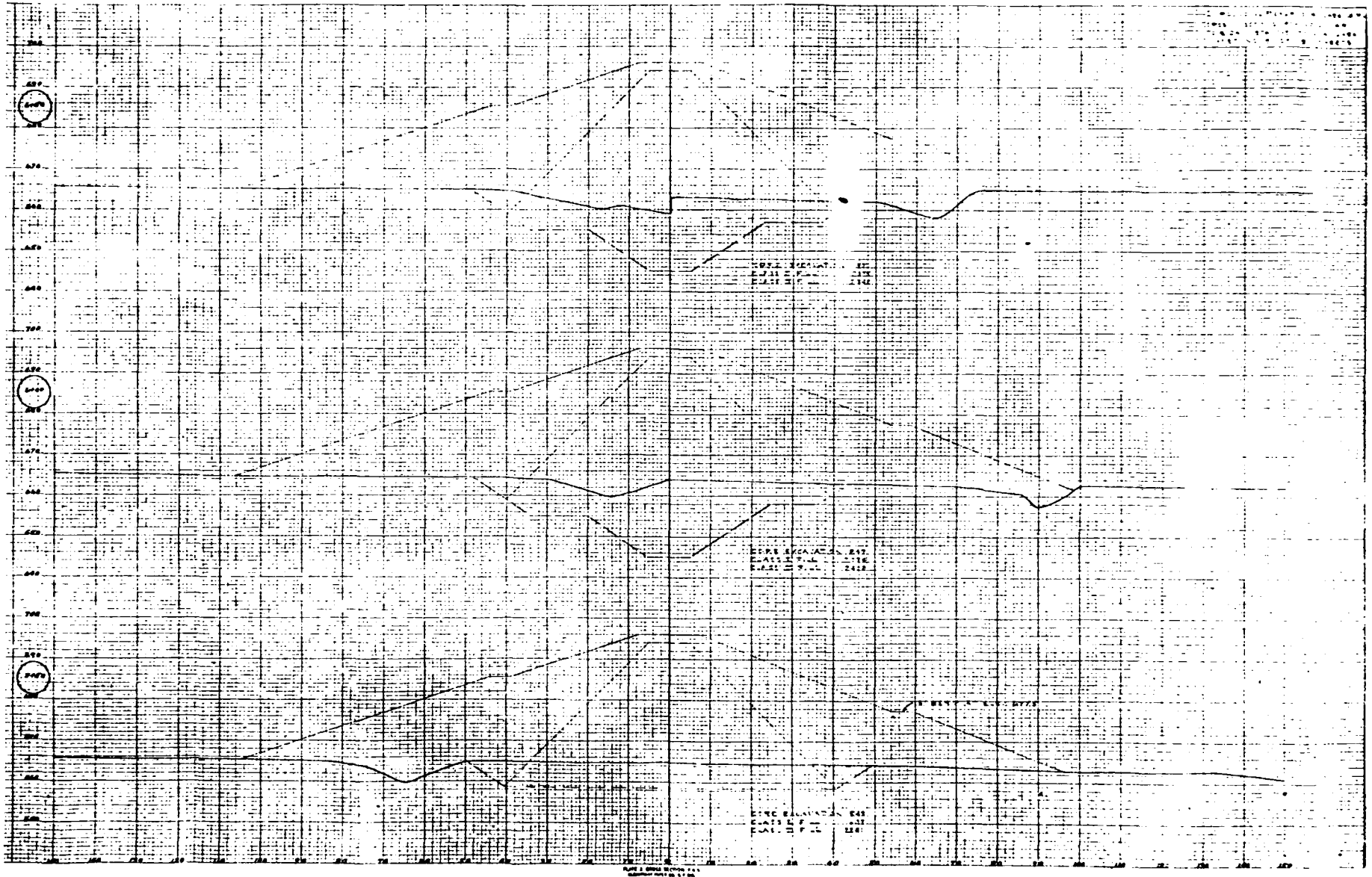


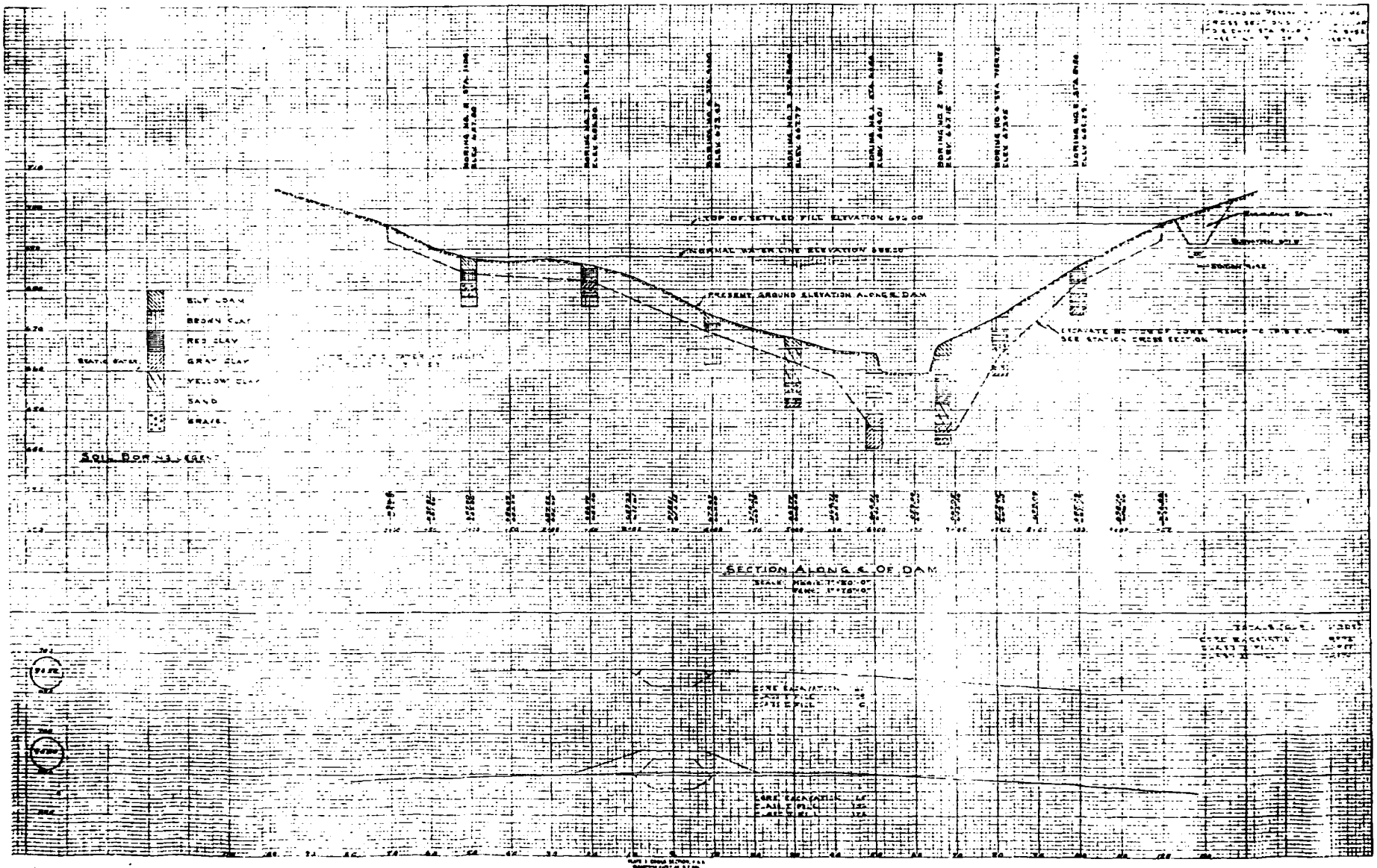
LOCATION MAP
NEW LABELLE LAKE DAM
LEWIS COUNTY, MISSOURI

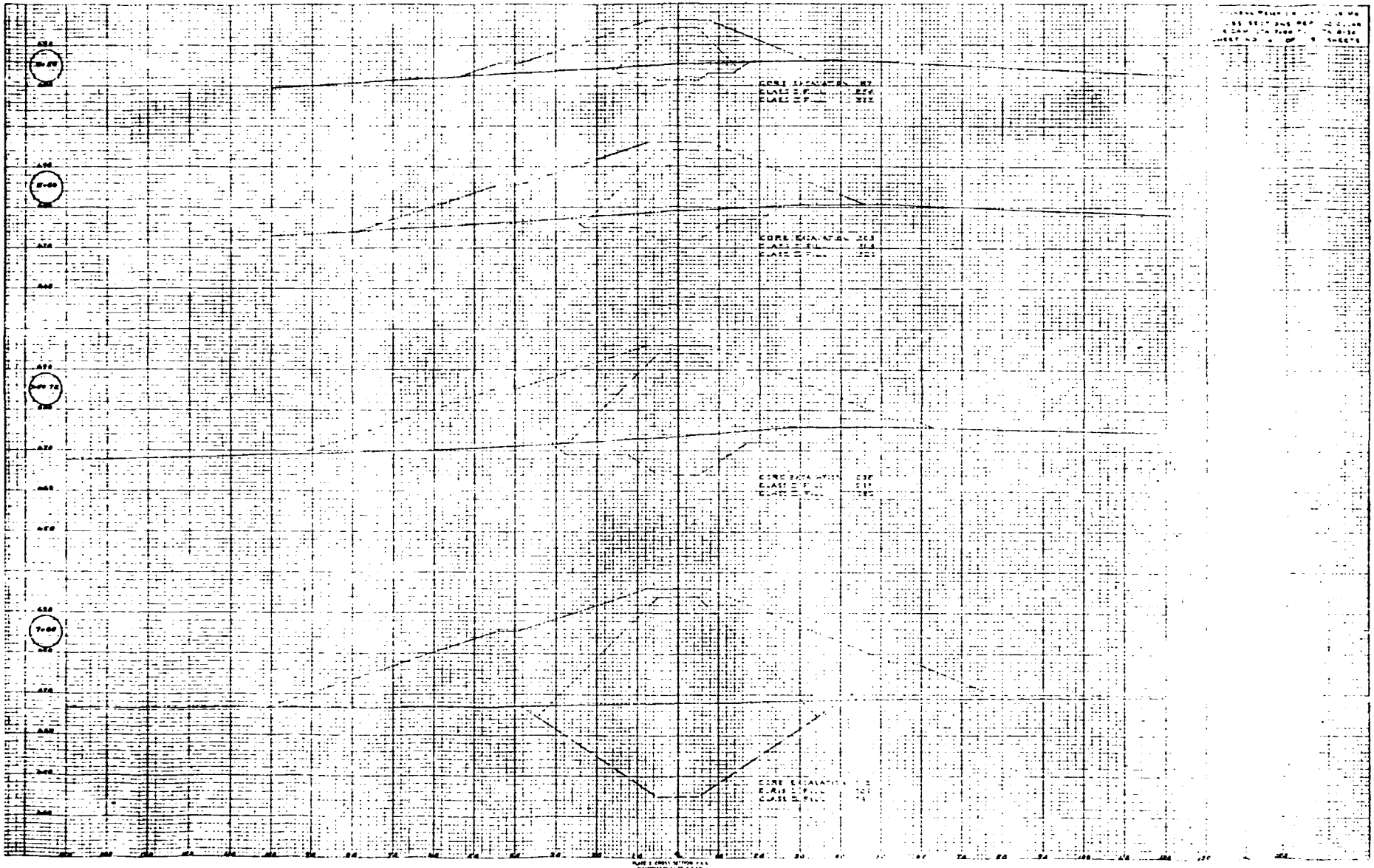

BORROW AREA
BORROW AREA
DESIGN DATA
NOTES
LEGEND
CITY OF LABELLE, MISSOURI
GENERAL PLAN
IMPOUNDING RESERVOIR & APPURTENANCES
W.H. KLINGNER & ASSOC., CONSULTING ENGINEERS
BEN W.C.U. BUILDING
ELMHURST, ILLINOIS
DESIGN: W.C. BOYD
APPROVED: W.H. KLINGNER
DRAWN: A.B. ARSLAN
DATE: MAY 1984
SHEET NO. 2 OF 15 SHEETS

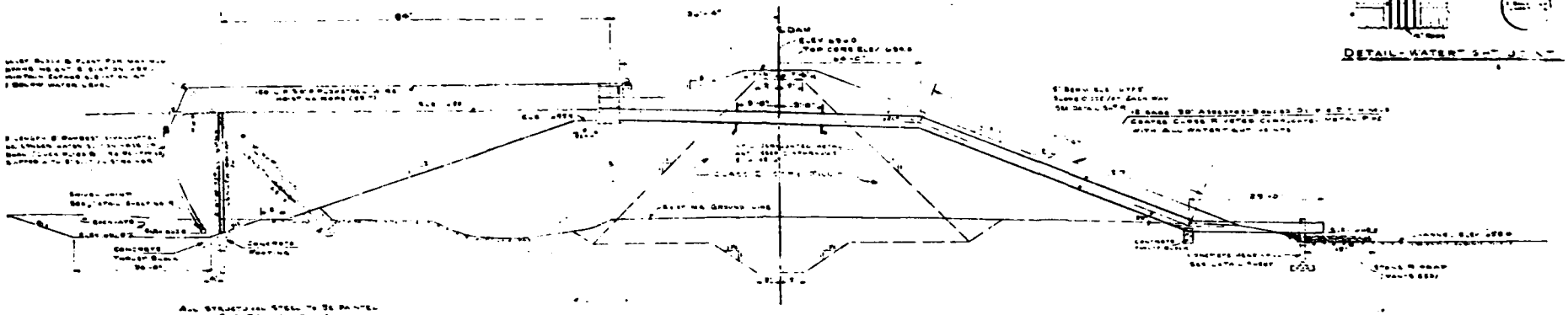




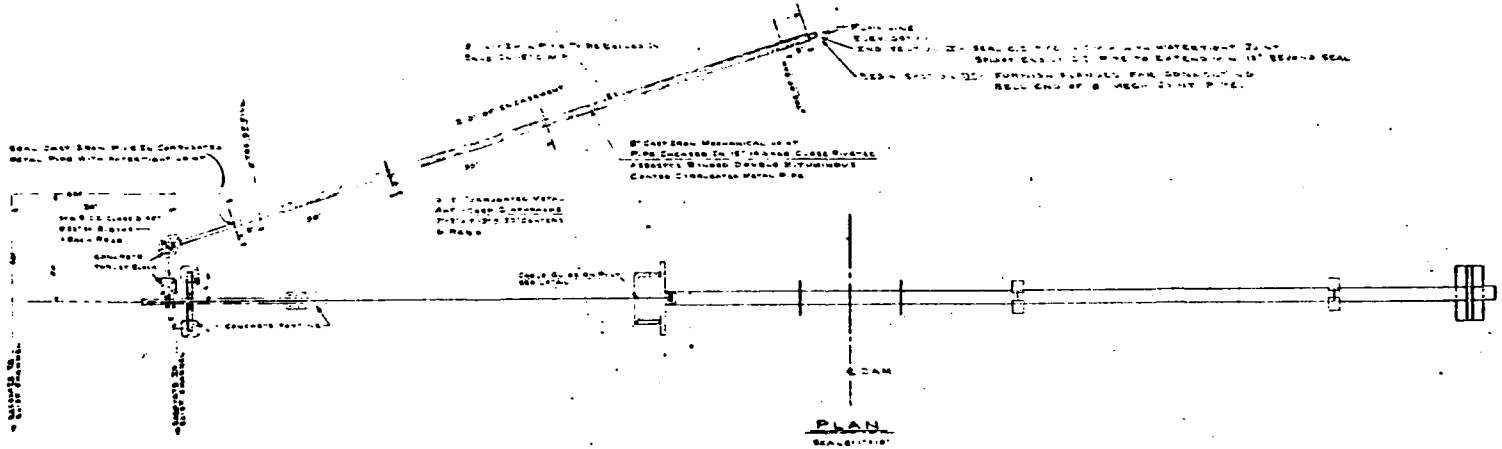



TOP OF SETTLED FILL ELEVATION 674.00
NORMAL WATER LINE ELEVATION 666.00
PRESENT GROUND ELEVATION ALONG ℄ DAM
SILT LOAM
BROWN CLAY
RED CLAY
GRAY CLAY
YELLOW CLAY
SAND
GRAVEL
SOIL BORING LEGEND
SECTION ALONG ℄ OF DAM

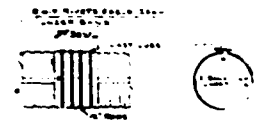




LONGITUDINAL SECTION ALONG ℄ OF STRUCTURE



PLAN



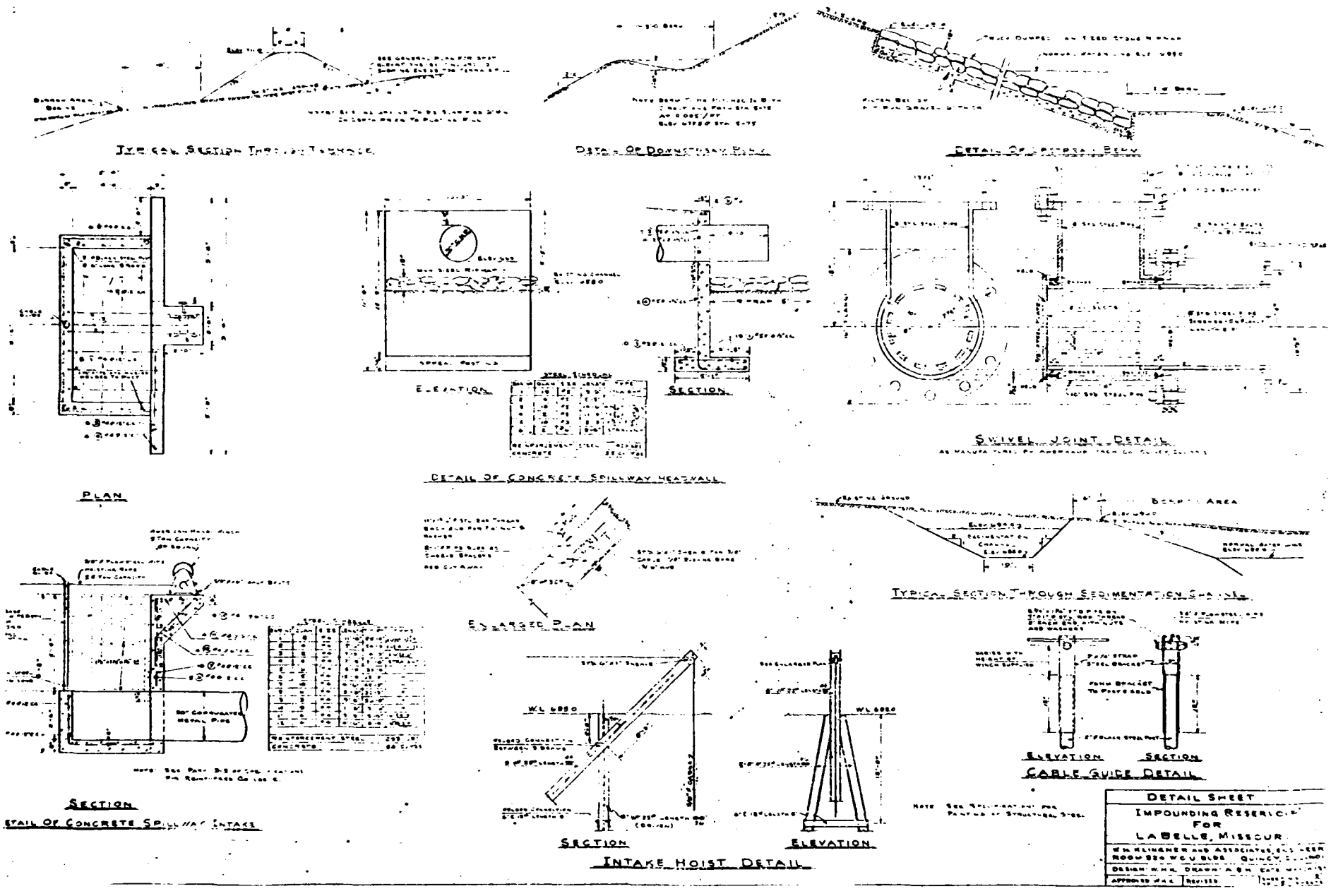
DETAIL - WATER SHUT OFF

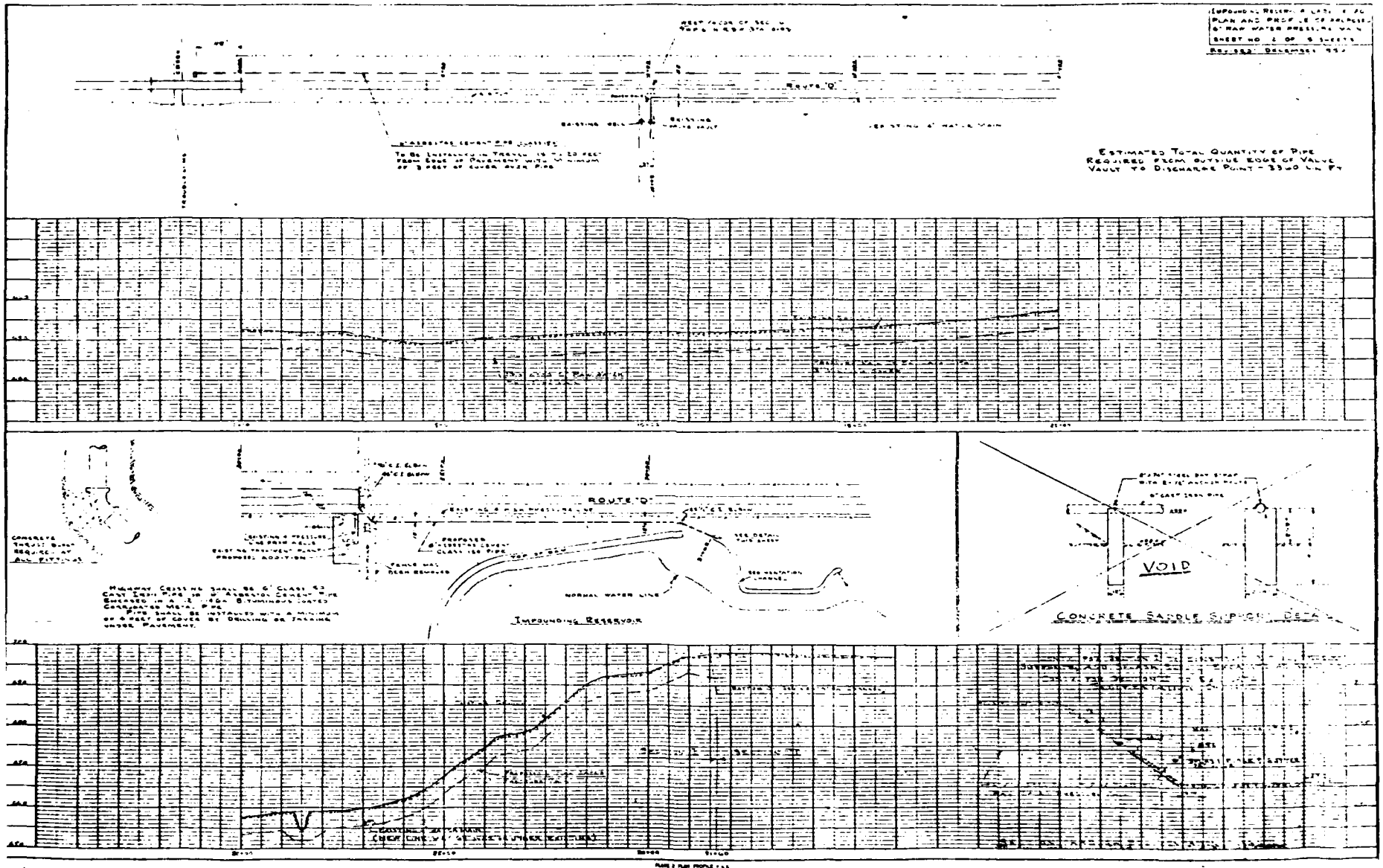
MECHANICAL SPILLWAY & INTAKE LAYOUT

IMPOUNDING RESERVOIR
FOR
LA BELLE, MISSOURI

W. H. KLOSENER AND ASSOCIATES, ENGINEERS
ROOM 524 N.C.U. BLDG. QUINCY, ILLINOIS

DESIGN W.H.K. DRAWN A.B.H. DATE
APPROVED REVISED


Typical Section Through Levee
Details Of Downstream Berm
Details Of Interior Berm
Plan
Elevation
Section
Detail Of Concrete Spillway Headwall
Swivel Joint Detail
Section
Detail Of Concrete Spillway Intake
Enlarged Plan
Typical Section Through Sedimentation Chamber
Section
Elevation
Cable Guide Detail
Section
Elevation
Intake Hoist Detail
Detail Sheet
Impounding Reservoir
For
La Belle, Missouri

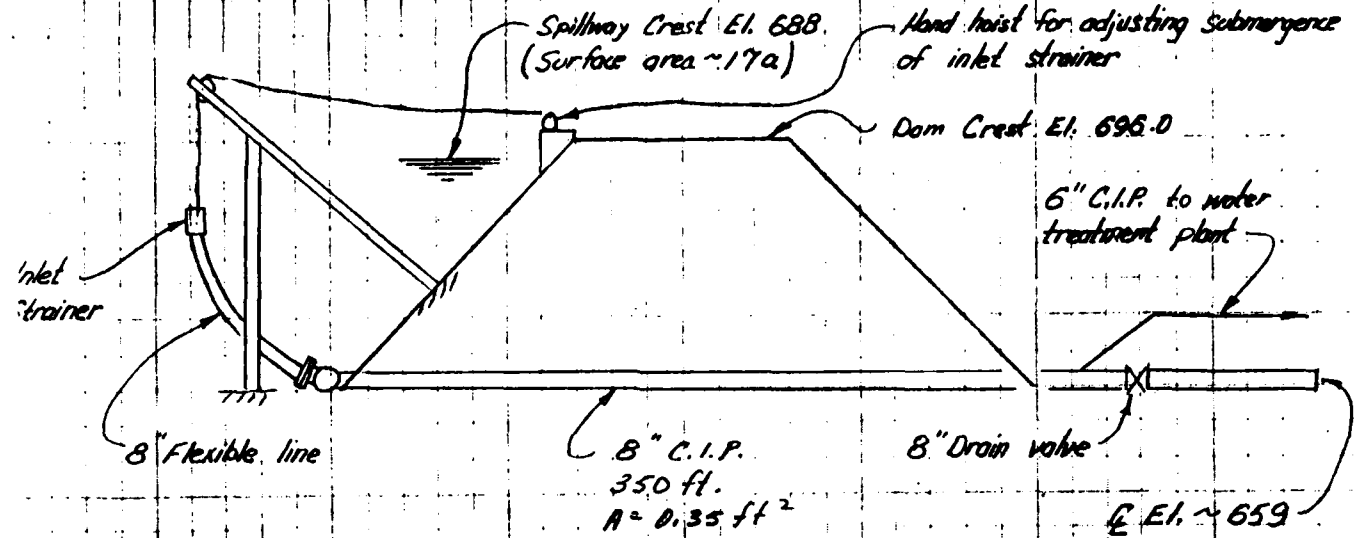

ROUTE "Q"
ESTIMATED TOTAL QUANTITY OF PIPE REQUIRED FROM OUTSIDE EDGE OF VALVE VAULT TO DISCHARGE POINT - 3300 LIN. FT.
IMPOUNDING RESERVOIR
NORMAL WATER LINE
CONCRETE SADDLE SUPPORT DETAIL
VOID

ENGINEERING CONSULTANTS, INC.

LABELLE DAM - MISSOURI — SHEET NO. 1 OF

JOB NO. 1223

RATING CURVE FOR DRAIN OUTLET — BY JCI DATE 10/12/78



Only significant losses are entrance loss, pipe friction, plus exit velocity head.

Pipe friction

From Hyd. Institute Tables $F \cong 2.75$ where $h_f = F \frac{v^2}{2g}$ per 100'

Increase about 15% for ageing $F = 1.15 \times 2.75 \times \frac{350}{100} = 11.1$

$$h_f = 11.1 \frac{v^2}{2g}$$

Entrance Loss:

Assume $K = 1.$

$$h_L = 1.0 \frac{v^2}{2g}$$

Exit Vel. Head $= 1.0\, v^2/2g$

Total

$11.1\, v^2/2g$	- Friction
1.0	- Entrance
1.0	- Outlet
$13.1\, v^2/2g$	

ENGINEERING CONSULTANTS, INC.

LABELLE DAM · MISSOURI

SHEET NO. 2 OF

JOB NO. 1223

BY JCI DATE 10/17/78

$$H_{TOTAL} = 13.1\ v^2/2g = \frac{11.1\,Q^2}{A^2(2g)} = \frac{11.1\,Q^2}{(0.35)^2(2g)}$$

$$Q = 0.35\sqrt{\frac{2gH}{11.1}} = 0.84\sqrt{H}\ \text{CFS}$$

EL. FT	H-FT	Q-CFS
663	4	1.7
665	6	2.1
670	11	2.8
675	16	3.4
680	21	3.8
685	26	4.3
688	29	4.5

Drawdown rate at design pool elevation

Surface area = 17 acres

Time to drawdown <u>one</u> foot

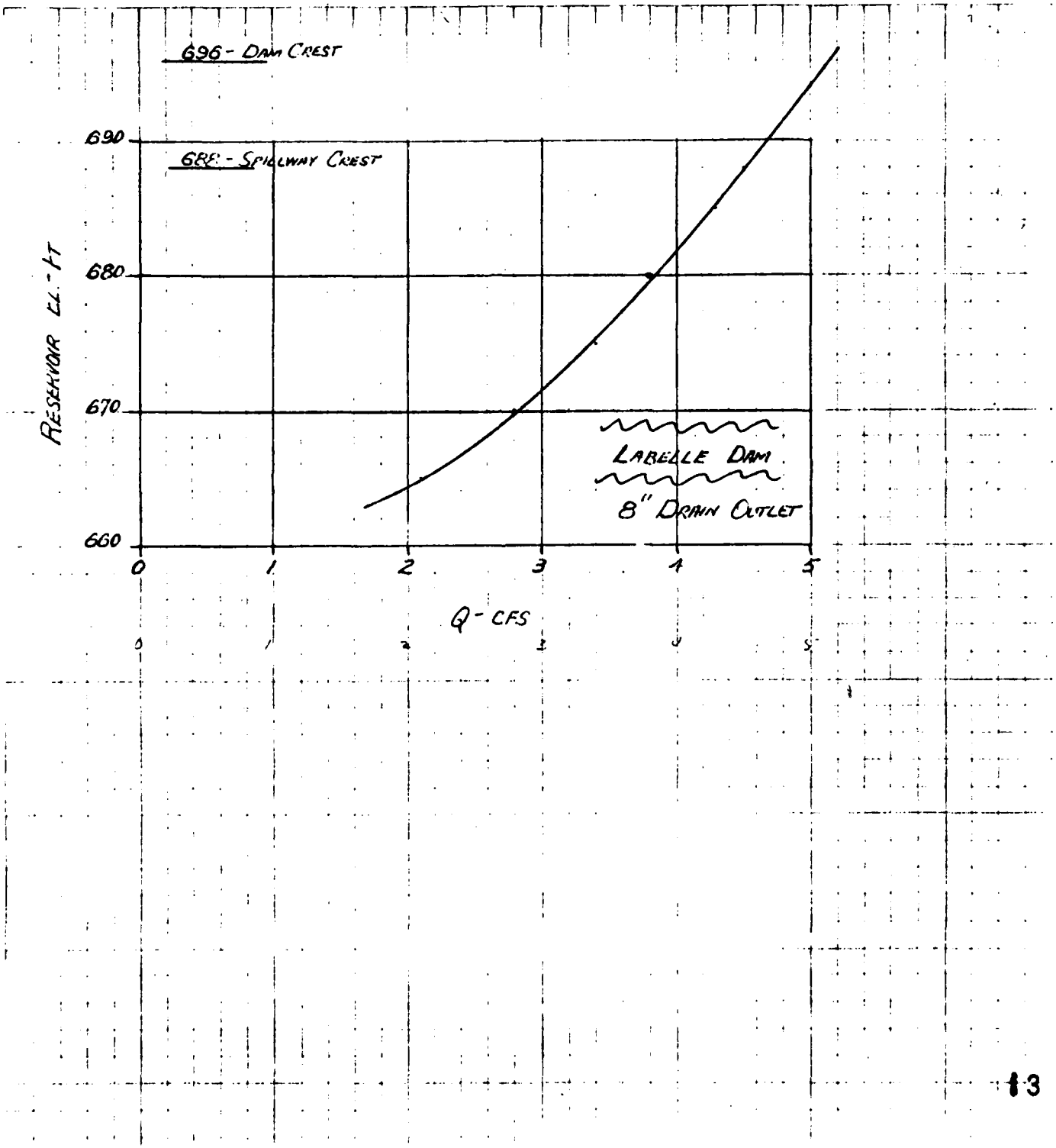
$$= \frac{17\,a \times 43{,}560\ ft^2/a}{4.7\ ft^3/s \times 60 \times 60 \times 24} \rightarrow 1.8\ \text{days}$$

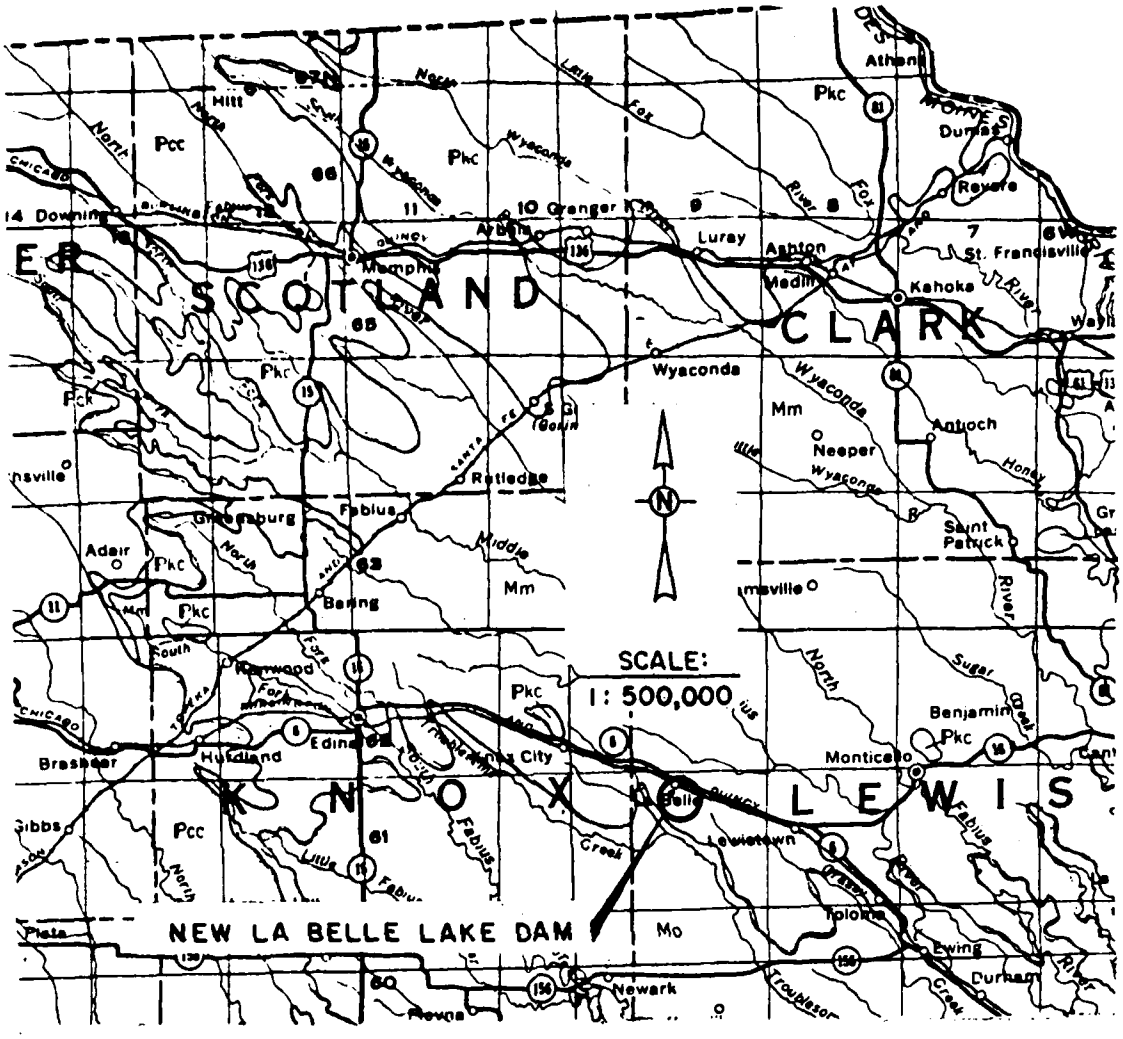
ENGINEERING CONSULTANTS, INC.

LABELLE DAM - MISSOURI — SHEET NO. 3 OF

JOB NO. 1323

RATING CURVE FOR DRAIN OUTLET — BY JCI DATE 10/17/78





Explanation

Pennsylvanian System

P_{kc} - Kansas City group: cyclic deposits with numerous limestones.
P_{pwm} - Pleasanton group: sandstone channel member.
P_{m} - Marmaton group: cyclic deposits with limestones.
P_{cc} - Cherokee group: cyclic deposits, predominately shale, sandstone and coal beds.

Mississippian System

M_{m} - sandy, oolitic, fossiliferous, lithographic, or cherty limestones.
M_{o} - cherty, crinoidal limestone, with some shale.
M_{k} - intercalated limestones and shales.

Reference: Geologic Map of Missouri, 1961, Division of Geological Survey and Water Resources, State of Missouri.

General Geologic Map

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

NEW LABELLE LAKE DAM

Photo 1 - View along crest of dam taken at right abutment.

Photo 2 - View of downstream slope of dam taken across road downstream of dam.

Photo 3 - Picture of downstream slope of dam at section with outlet works and spillway pipes.

Photo 4 - Picture of upstream slope to right of drop inlet spillway taken at crest near spillway.

Photo 5 - Picture of grass-lined spillway at left abutment taken from spillway channel.

Photo 6 - Picture of water supply pumping house. Note downstream slope of dam in background.

Photo 7 - Picture of drop inlet for service spillway along with hoist arrangement for water supply piping.

Photo 8 - Picture of hoist arrangement for water supply piping.

Photo 9 - Close-up of inlet structure for service spillway. Note cracked concrete on outside concrete wall.

Photo 10 - Close-up of cracked concrete on outside wall of inlet structure.

Photo 11 - Close-up of crack on concrete wall above entrance to corrugated metal pipe in drop inlet structure.

Photo 12 - Picture of entrance to corrugated metal pipe in drop inlet structure.

Photo 13 - Picture of discharge and of corrugated metal pipe used for service spillway.

Photo 14 - Picture of inlet to corrugated metal pipe culvert under gravel road downstream of dam.

Photo 15 - Close-up of location of seep through downstream embankment slope above discharge end of corrugated metal pipe service spillway.

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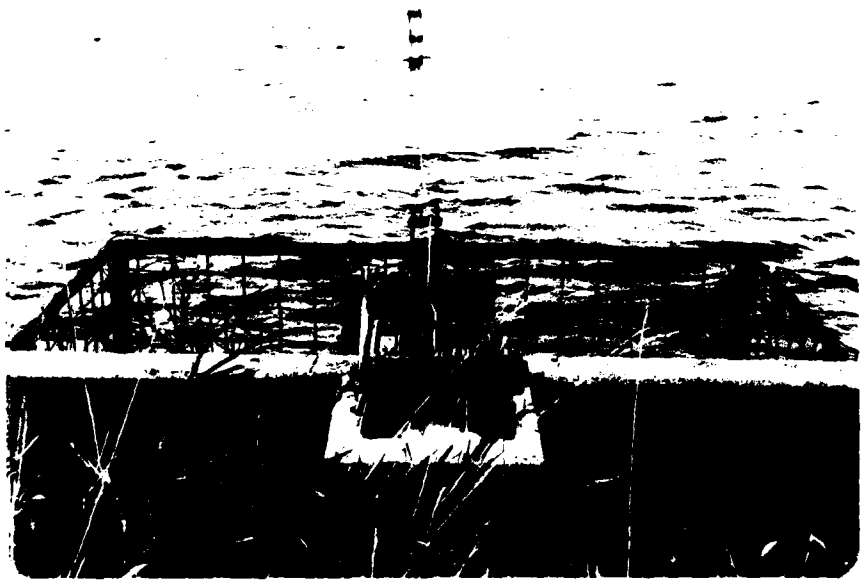

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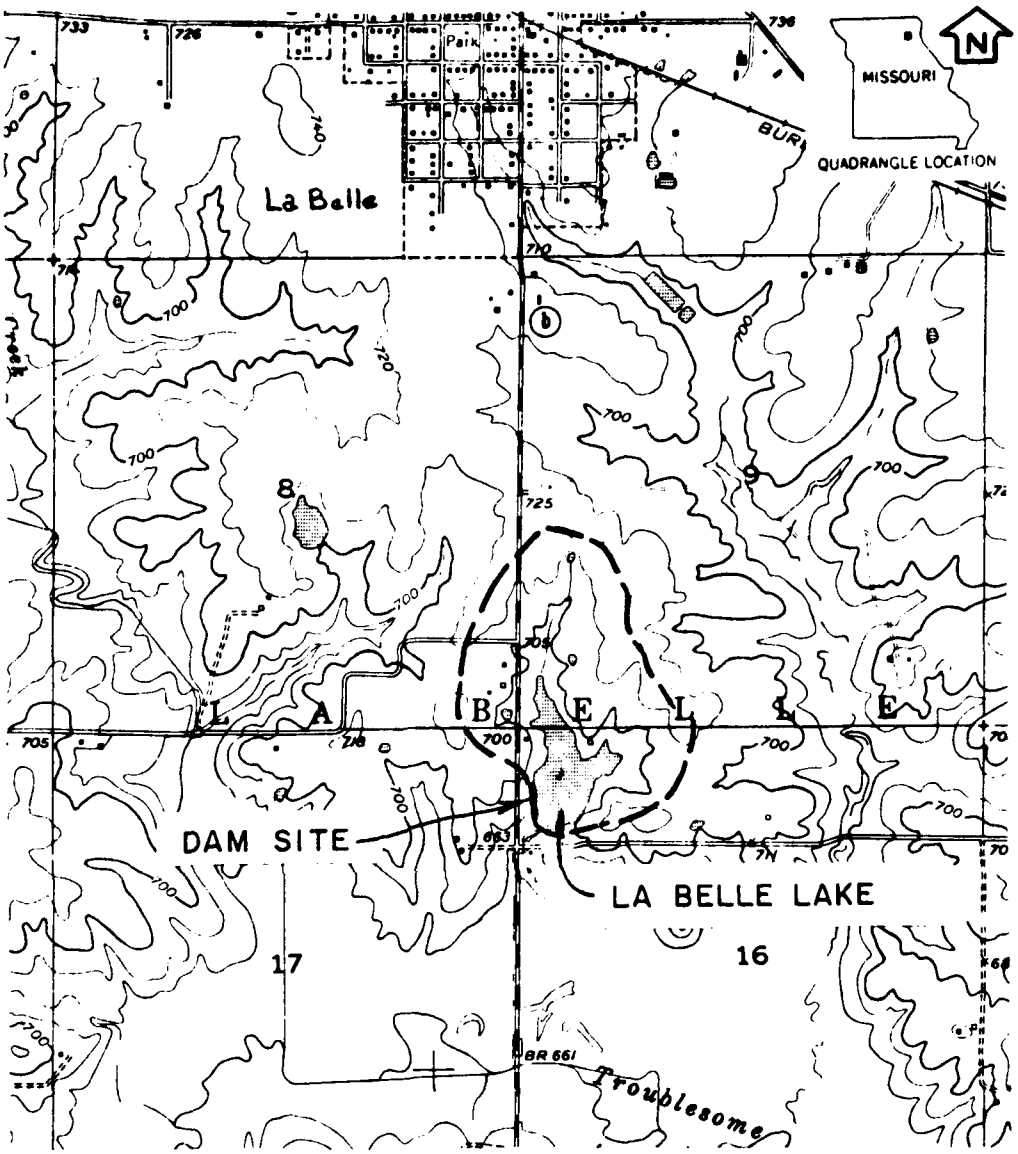
Photo 14 - Picture of inlet to corrugated metal pipe culvert under gravel road downstream of dam.

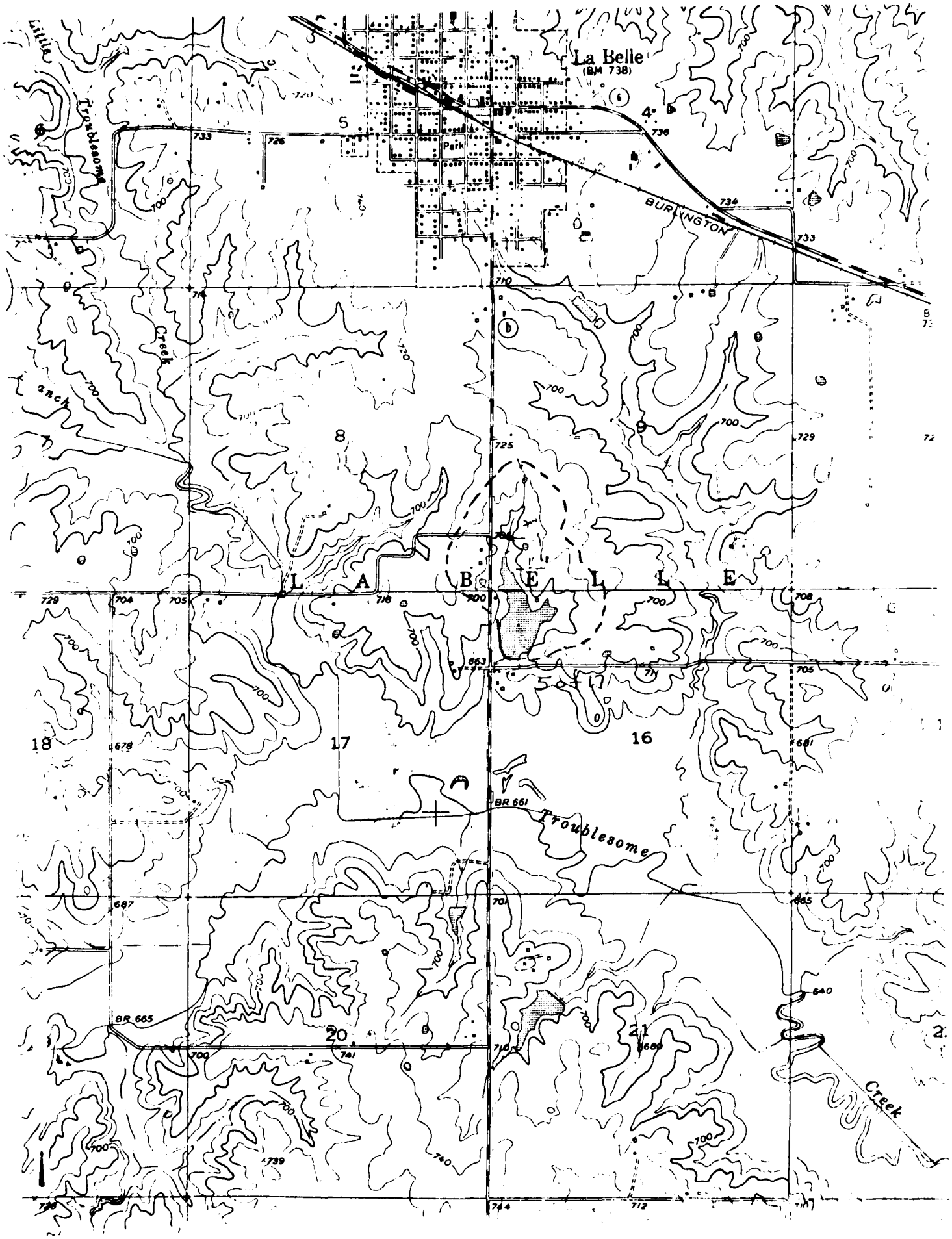
Photo 15 - Close-up of location of seep through downstream embankment slope above discharge end of corrugated metal pipe service spillway.

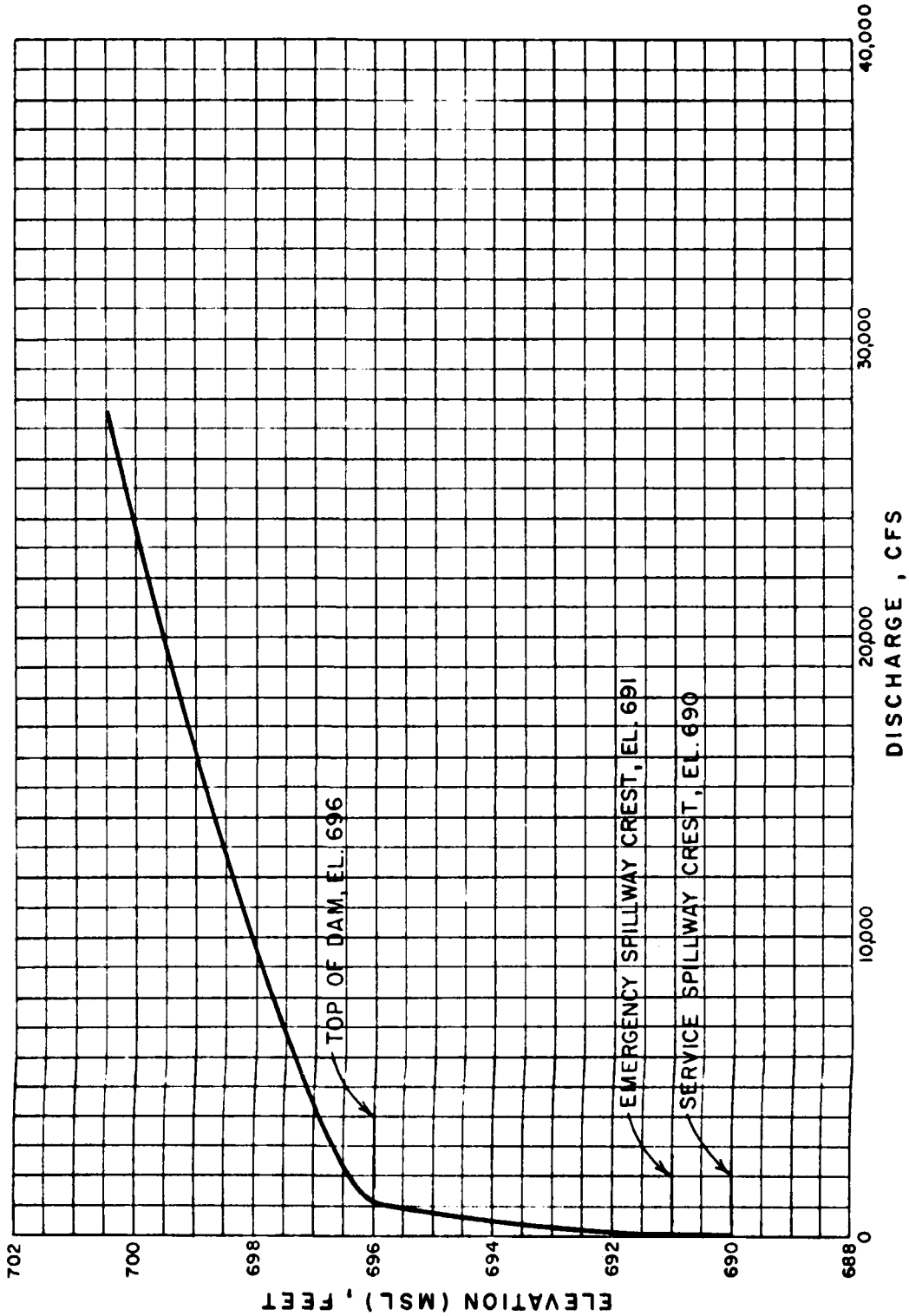
APPENDIX B

HYDROLOGIC COMPUTATIONS

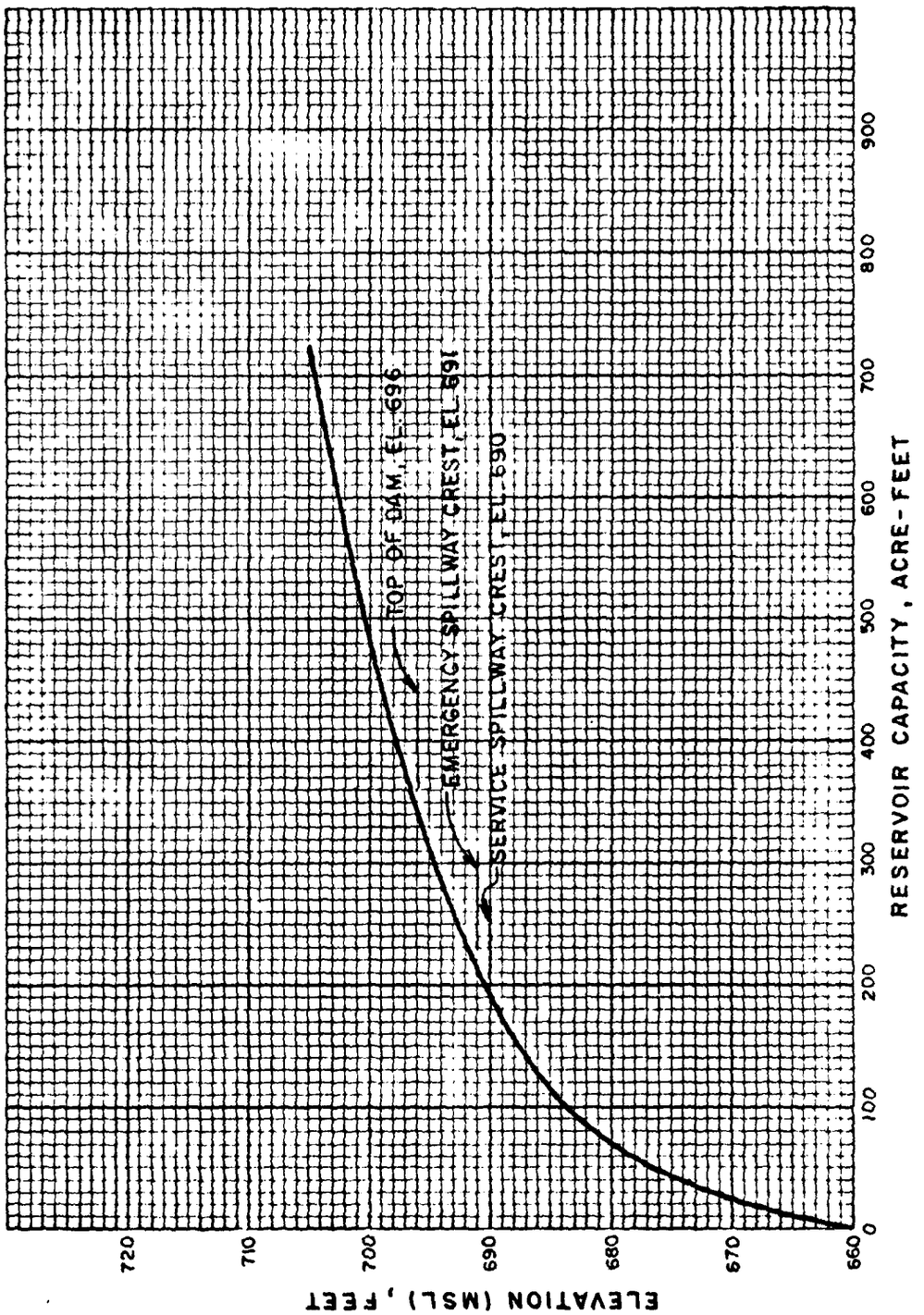


NEW LA BELLE LAKE DAM
DRAINAGE AREA


La Belle
(BM 738)
Park
BURLINGTON
Little
Troublesome
Creek
L A B E L L E
5 of 17
BR 661
Troublesome
BR 665
Creek
5
4
8
9
18
17
16
20
21



NEW LA BELLE LAKE DAM
COMBINED SPILLWAYS & OVERTOP RATING CURVE



NEW LA BELLE LAKE DAM
RESERVOIR CAPACITY CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI
NEW LABELLE LAKE DAM
RESERVOIR AREA CAPACITY DATA

SHEET NO. 1 OF
JOB NO. 1223-001-1
BY KLB DATE
GMW

NEW LABELLE DAM

RESERVOIR AREA CAPACITY DATA

Data used based on USGS

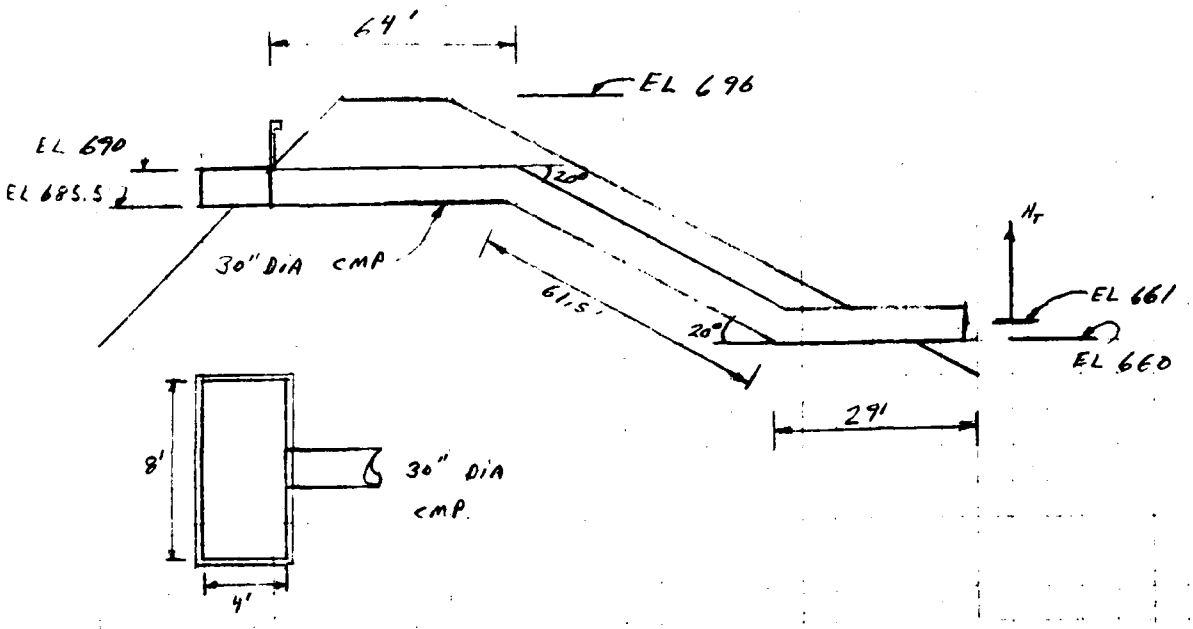
ELEV. FT.	SURFACE AREA (ACRES)	INCREMENTAL VOLUME (AC-FT)	TOTAL VOLUME (AC-FT)	REMARKS
660.0	0	—	0	STREAM BED AT CENTER OF DAM
688.0	17	152	152	
690	19.9*	42	194	SERVICE SPILLWAY CREST
691	21.5*	16	210	EMERGENCY SPILLWAY CREST
696	30.0*	129	339	TOP OF DAM
700	40.	140	479	
705	58*	245	724	

* INTERPOLATED DATA

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 1 OF
NEW LABENE LAKE DAM — JOB NO. 1223-001-1
SERVICE SPILLWAY CAPACITY — BY KLB DATE 10-18-78

NEW LABENE LAKE



UPSTREAM W.S ELEV AT 690.5

a) WEIR FLOW

ASSUME $C = 3.1$

$$Q_W = C L H^{3/2} = 3.1 \times 16 \times 0.5^{1.5} = 18 \text{ CFS}$$

b) PIPE FLOW

ASSUME $n = 0.025$, $K_e = 0.5$, $K_b = 0.16$ (FOR 20° BENDS)

$$H_T = \left(1 + K_e + K_b + K_b + \frac{29 n^2 L}{R^{1.333}}\right) \frac{V^2}{2g}$$

$$H_T = \left(1 + 0.5 + 0.16 + 0.16 + \frac{29 (0.025^2 \times 154.5)}{0.625^{1.333}}\right) \frac{V^2}{2g}$$

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION -- MISSOURI
NEW LABELLE DAM
SERVICE SPILLWAY CAPACITY

SHEET NO. 2 OF
JOB NO. 1223-001-1
BY KLB DATE 11-2-78

$$H_T = 7.06 \frac{V^2}{2g}$$

$$V = \frac{1}{\sqrt{7.06}} \sqrt{2g H_T} = 0.376 \sqrt{2g H_T}$$

$$\boxed{Q = V \cdot A = 0.376\, A \sqrt{2g H_T}}$$

$$Q = 0.376 \times 4.91 \times \sqrt{64.4 \times 29.5} = 80.\ \text{CFS}$$

ACTUAL $\underline{Q = 18\ \text{CFS}}$

UPSTREAM W.S. AT ELEV. 691

a) WEIR FLOW

$$Q = CLH^{3/2} = 3.1 \times 16 \times 1^{3/2} = 50\ \text{CFS}$$

b) PIPE FLOW

$$Q = 0.376 \times A \times \sqrt{2g H_T}$$

$$= 0.376 \times 4.91 \times \sqrt{64.4 \times 30}$$

$$Q = 81\ \text{CFS}$$

$\underline{\text{ACTUAL } Q = 50\ \text{CFS.}}$

UPSTREAM W.S. AT 691.73

a) WEIR FLOW

$$Q = CLH^{3/2} = 3.1 \times 16 \times 1.73^{3/2} = 113\ \text{CFS.}$$

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI
NEW LABELLE LAKE DAM
SERVICE SPILLWAY CAPACITY

SHEET NO. 3 OF
JOB NO. 1273-001-1
BY KLB DATE 10-18-78

UPSTREAM W.S. AT EL 691.73

PIPE FLOW CONTROLS

$Q = 0.376 \times A \times \sqrt{2g H_T} = 0.376 \times 4.91 \times \sqrt{64.4 \times 30.73}$

$Q = 82$ CFS

UPSTREAM W.S. AT EL 692.44

PIPE FLOW CONTROLS

$Q = 0.376 \times A \times \sqrt{2g H_T} = 0.376 \times 4.91 \times \sqrt{64.4 \times 31.44}$

$Q = 83$ CFS

UPSTREAM W.S. AT EL 695.14

PIPE FLOW CONTROLS

$Q = 0.376 \times A \times \sqrt{2g H_T} = 0.376 \times 4.91 \times \sqrt{64.4 \times 34.14}$

$Q = 87$ CFS

UPSTREAM W.S. AT ELEV 696.45

PIPE FLOW CONTROLS

$Q = 0.376 \times A \times \sqrt{2g H_T} = 0.376 \times 4.91 \times \sqrt{64.4 \times 35.45}$

$Q = 88$ CFS

UPSTREAM W.S. AT ELEV 697.45

PIPE FLOW CONTROLS

$Q = 0.376 \times A \times \sqrt{2g H_T} = 0.376 \times 4.91 \times \sqrt{64.4 \times 36.45}$

$Q = 89$ CFS

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI
NEW LABELLE LAKE DAM
SERVICE SPILLWAY CAPACITY

SHEET NO. 4 OF ____
JOB NO. 1223-001-1
BY KLB DATE 10-18-78

UPSTREAM W.S AT ELEV. 699.13

PIPE FLOW CONTROLS

$Q = 0.376 \times A \times \sqrt{2gH_T} = 0.376 \times 4.91 \times \sqrt{64.4 \times 38.13}$

$\underline{Q = 91 \text{ CFS}}$

UPSTREAM W.S. AT ELEV. 700.45

PIPE FLOW CONTROLS

$Q = 0.376 \times A \times \sqrt{2gH_T} = 0.376 \times 4.91 \sqrt{64.4 \times 39.45}$

$\underline{Q = 93 \text{ CFS}}$

ECI-4 ENGINEERING CONSULTANTS, INC.

(1) SAFETY INSPECTION - MISSOURI

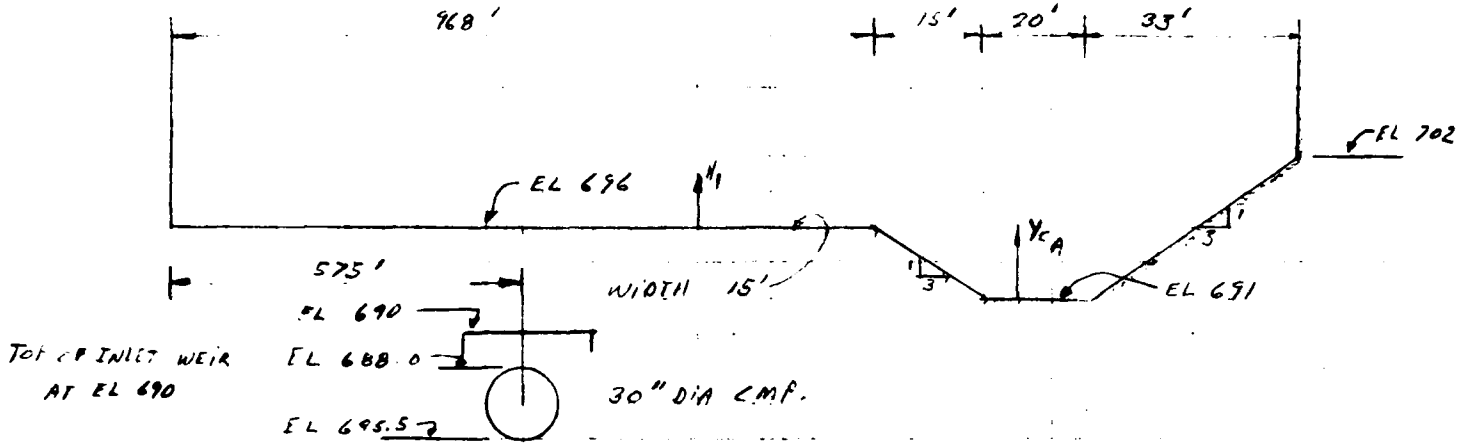
NEW LABELLE LAKE DAM

EMERGENCY SPILLWAY AND OVERTOP DISCHARGE CAPACITY

SHEET NO. 1 OF

JOB NO. 1223-001.1

BY KLB DATE 10-15-15



Y_{CA} (FT.)	T_{CA}	A_{CA}	$V_{CA} = 5.67\sqrt{\frac{A_{CA}}{T_{CA}}}$	U/S W.S. W.R.T. CHANNEL BOT. $= Y_{CA} + \frac{V_{CA}^2}{2g} + 691$	$Q_{CA} = V_{CA} \times A_{CA}$	H_1	L_1	C_1	$Q_T = Q_{CA} + C_1 L_1 H_1^{3/2}$
0.5	23	10.75	3.88	691.73	42	–	–	–	42
1.0	26	23	5.33	692.44	123	–	–	–	123
3.0	38	87.	8.58	695.14	746	–	–	–	746
4.0	44	128	9.67	696.45	1238	0.45	968	2.70	2027
5.0	50	175	10.61	697.75	1856	1.75	968	2.63	6591
6.0	53	226.5	11.72	699.13	2655	3.13	968	2.63	16753
7.0	56	281	12.57	700.45	3531	4.45	968	2.63	27430

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI
NEW LABELLE LAKE DAM
COMBINED SERVICE SPILLWAY, EMERGENCY SPILLWAY AND OVERTOP DISCHARGE CAPACITY

SHEET NO. 1 OF
JOB NO. 1223-001-1
BY KLB DATE 11-2-78

ELEV. (FT) M.S.L.	SERVICE SPILLWAY DISCHARGE (CFS)	EMERGENCY SPILLWAY DISCHARGE (CFS)	OVERTOP DISCHARGE (CFS)	TOTAL DISCHARGE (CFS)
690.00	0	-	-	0
690.50	18	-	-	18
691.00	50	-	-	50
691.73	82	42	-	124
692.44	83	123	-	206
695.14	87	746	-	833
696.45	88	1238	789	2115
697.45	89	1856	4735	6680
699.13	91	2655	14098	16844
700.45	93	3531	23899	27523

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 1 OF
NEW LA BELLE LAKE — JOB NO. 1223-001-1
UNIT HYDROGRAPH PARAMETERS — BY KLB — DATE 10-4-78

1. DRAINAGE AREA = 176 ACRES = 0.28 SQ. MI.

2. LENGTH OF STREAM = L = (0.9" × 2000')/5280 = 0.34 MI.

3. DIFFERENCE IN ELEVATION: ΔH

$$\Delta H = 723 - 690 = 33'$$

4. TIME OF CONCENTRATION

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385}$$

$$T_c = \left(\frac{11.9 \times 0.34^3}{33}\right)^{0.385} = \underline{0.19 \text{ HR}}$$

5. LAG TIME = L_t $0.6 \times T_c$

$$L_t = 0.6 \times 0.19 = 0.11 \text{ HR}$$

6. RAINFALL UNIT DURATION = D

$$D \leq \frac{L_t}{3} = \frac{0.11}{3} = 0.04 \text{ HR}$$

USE $D = 5 \text{ MIN} = \underline{0.083} \text{ HR}$

(MINIMUM VALUE ACCORDING TO SLD CRITERIA)

7. TIME TO PEAK

$$T_p = \frac{D}{2} + 0.6 \times T_c = \frac{0.083}{2} + 0.6 \times 0.19$$

$$T_p = 0.156 \text{ HR}$$

8. $$q_p = \frac{484 \times A}{T_p} = \frac{484 \times 0.28}{0.156} = 868.72 \text{ CFS.}$$

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 2 OF

NEW LA BELLE LAKE DAM — JOB NO. 1223-001.1

UNIT HYDROGRAPH DERIVATION — BY KLB DATE 10-4-78

9.) CURVILINEAR UNIT HYDROGRAPH

TIME T/T_p	DISCHARGE q/q_p	UNIT HYDROGRAPH	
		TIME, T (HR)	DISCHARGE (CFS)
0.0	0.000	0.00	0.000
0.1	0.015	0.02	13.03
0.2	0.075	0.03	65.15
0.3	0.16	0.05	139.00
0.4	0.28	0.06	243.24
0.5	0.45	0.08	390.92
0.6	0.60	0.09	521.23
0.7	0.77	0.11	668.91
0.8	0.89	0.12	773.16
0.9	0.97	0.14	842.66
1.0	1.00	0.16	868.72
1.1	0.98	0.17	851.35
1.2	0.92	0.19	799.22
1.3	0.84	0.20	729.72
1.4	0.75	0.22	651.54
1.5	0.66	0.23	573.36
1.6	0.56	0.25	486.48
1.8	0.42	0.28	364.86
2.0	0.32	0.31	277.99
2.2	0.24	0.34	208.49
2.4	0.18	0.37	156.37
2.6	0.13	0.41	112.93
2.8	0.098	0.44	85.13
3.0	0.075	0.47	65.15
3.5	0.036	0.55	31.27
4.0	0.018	0.62	15.64
4.5	0.009	0.70	7.82
5.0	0.004	0.78	3.47

183.76

NEW LABELLE LAKE DAM

DETERMINATION OF PMS

1. Determine drainage area of the basin

D.A. = 0.25 Sq.mi.

2. Determine PMP Index rainfall:

Location of centroid of basin:

Long. 91.91°; Lat.: 40.09°

→ PMP for 200 Sq.mi. & 24 hrs duration

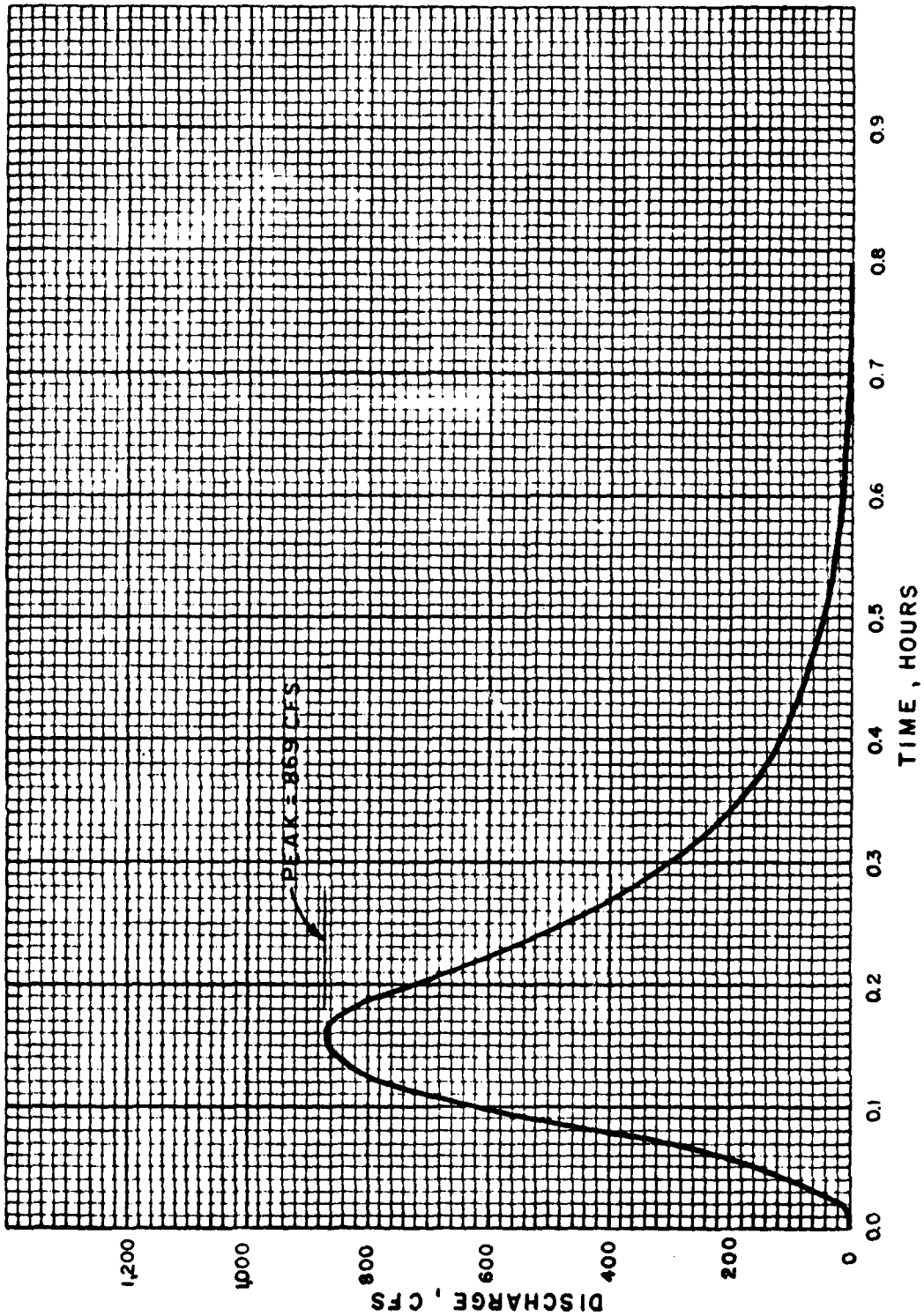
= 24" (from Fig 1, HMR NO 33)

3. Determine basin rainfall in terms of percentage of PMP Index rainfall for various durations:

Location: Long. 91.91°; Lat. 40.09°

⇒ Zone 7

Duration (Hrs.)	Percent of Index rainfall (%)	Total rainfall (Inches)	Rainfall increments (Inches)	Duration of increment (Hrs.)
6	100	24	24	6
12	120	28.8	4.8	6
24	130	31.2	2.4	12



NEW LA BELLE LAKE DAM
5 MINUTE UNIT HYDROGRAPH

NEW LABELLE LAKE DAM

100-YR FLOOD BY REGRESSION EQ.

Regression equation for 100-year flood for Missouri:

$$Q_{100} = 85.1 A^{0.934} A^{-0.02} S^{0.576}$$

where A = drainage area in sq. mi.

S = main channel slope, ft/mi.

(Avg slope between 0.1L & 0.85L)

For New Labelle Lake Dam:

A = 158 acres = 0.25 sq. mi.

S = 34 ft / 0.26 mi = 130.77 ft/mi

$$Q_{100} = 85.1 (0.25)^{0.934} (0.25)^{-0.02} (130.77)^{0.576}$$

$$= \underline{\underline{372 \text{ cfs}}}$$

HEC1DB INPUT DATA

```
*****************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1979
  LAST MODIFICATION  3 AUG 78
*****************************

     1          A                    DAM SAFETY INSPECTION - MISSOURI
     2          A                         NEW LABELLE LAKE DAM
     3          A              PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING
     4          B    300       0       5       0       0       0       0       0       0       0
     5          B1     5
     6          J      1       2       1
     7          J1   1.0     0.5
     8          K      0       4                                       1
     9          K1      INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH
    10          M      1      -1    0.28            0.28     1.0
    11          P           24.00     100     120     130
    12          T                                                   0.85    0.07
    13          U     11
    14          U1   0.0     420.    869.    490.    225.    100.     45.     25.     15.      2.
    15          U1    0.
    16          X             0.      1
    17          K      1       4                       2                       1
    18          K1      ROUTE HYDROGRAPH THROUGH NEW LABELLE LAKE DAM
    19          Y                                   1       1
    20          Y1     1                                            -690.     -1
    21          Y4690.00  690.50  691.00  691.73  692.44  695.14  696.00  696.45  697.45  699.13
    22          Y4700.45
    23          Y5   0.0      18.     50.    124.    206.    833.   1200.   2115.   6680.  16844.
    24          Y527523.
    25          $S     0.    152.    194.    210.    339.    449.    724.
    26          $E   660.    688.    690.    691.    696.    700.    705.
    27          $$693.00
    28          $D696.00
    29          K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	4
ROUTE HYDROGRAPH TO	4
END OF NETWORK	

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

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*******************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  3 AUG 78
*******************************

RUN  DATE= 78/11/02.
     TIME= 13.51.08.


                    DAM SAFETY INSPECTION - MISSOURI
                       NEW LABELLE LAKE DAM
              PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING

                          JOB SPECIFICATION
          NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
         300       0       5       0       0       0       0       0       0       0
                            JOPER     NWT   LROPT   TRACE
                                5       0       0       0


                    MULTI-PLAN ANALYSES TO BE PERFORMED
                       NPLAN= 1 NRTIO= 2 LRTIO= 1
          RTIOS=   1.00    .50


**********      **********      **********      **********      **********

                       SUB-AREA RUNOFF COMPUTATION

              INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UN
                     ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                         4       0       0       0       0       0       1       0       0

                                HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1      41     .28    0.00     .28    1.00   0.000       0       0       0

                                 PRECIP DATA
                    SPFE     PMS      R6     R12     R24     R48     R72     R96
                    0.00   24.00  100.00  120.00  130.00    0.00    0.00    0.00

                                  LOSS DATA
          LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
              0    0.00    0.00    1.00    0.00    0.00    1.00     .85     .07    0.00    0.00

                          GIVEN UNIT GRAPH, NUHGQ=  11
             0.      420.      869.      490.      225.      100.       45.       25.       15.        2.
             0.
                    UNIT GRAPH TOTALS   2191. CFS OR 1.01 INCHES OVER THE AREA

                                RECESSION DATA
                        STRTQ=    0.00    QRCSN=    0.00    RTIOR= 1.00

                                END-OF-PERIOD FLOW
          MO.DA HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q
          1.01   .05       1    .01   0.00    .01       0.      1.01  12.35     151    .20    .19    .01     820.
```

1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.20	.19	.01	421.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.20	.19	.01	425.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.20	.19	.01	425.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.20	.19	.01	425.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.20	.19	.01	425.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.24	.23	.01	429.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.24	.23	.01	442.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.24	.23	.01	477.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.24	.23	.01	497.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	161	.24	.23	.01	506.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.30	162	.24	.23	.01	510.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.35	163	.24	.23	.01	511.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.40	164	.24	.23	.01	512.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.45	165	.24	.23	.01	513.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.50	166	.24	.23	.01	513.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.55	167	.24	.23	.01	513.
1.01	1.30	18	.01	0.00	.01	0.	1.01	14.00	168	.24	.23	.01	513.
1.01	1.35	19	.01	0.00	.01	0.	1.01	14.05	169	.30	.29	.01	513.
1.01	1.40	20	.01	0.00	.01	0.	1.01	14.10	170	.30	.29	.01	538.
1.01	1.45	21	.01	0.00	.01	0.	1.01	14.15	171	.30	.29	.01	590.
1.01	1.50	22	.01	0.00	.01	0.	1.01	14.20	172	.30	.29	.01	620.
1.01	1.55	23	.01	0.00	.01	0.	1.01	14.25	173	.30	.29	.01	633.
1.01	2.00	24	.01	0.00	.01	0.	1.01	14.30	174	.30	.29	.01	639.
1.01	2.05	25	.01	0.00	.01	0.	1.01	14.35	175	.30	.29	.01	642.
1.01	2.10	26	.01	0.00	.01	0.	1.01	14.40	176	.30	.29	.01	643.
1.01	2.15	27	.01	0.00	.01	0.	1.01	14.45	177	.30	.29	.01	644.
1.01	2.20	28	.01	0.00	.01	0.	1.01	14.50	178	.30	.29	.01	645.
1.01	2.25	29	.01	0.00	.01	0.	1.01	14.55	179	.30	.29	.01	645.
1.01	2.30	30	.01	0.00	.01	0.	1.01	15.00	180	.30	.29	.01	645.
1.01	2.35	31	.01	0.00	.01	0.	1.01	15.05	181	.36	.36	.01	645.
1.01	2.40	32	.01	0.00	.01	0.	1.01	15.10	182	.36	.36	.01	555.
1.01	2.45	33	.01	0.00	.01	0.	1.01	15.15	183	.36	.36	.01	530.
1.01	2.50	34	.01	0.00	.01	0.	1.01	15.20	184	.55	.54	.01	670.
1.01	2.55	35	.01	0.00	.01	0.	1.01	15.25	185	.64	.63	.01	810.
1.01	3.00	36	.01	0.00	.01	0.	1.01	15.30	186	1.55	1.54	.01	1036.
1.01	3.05	37	.01	0.00	.01	0.	1.01	15.35	187	2.55	2.55	.01	1601.
1.01	3.10	38	.01	0.00	.01	0.	1.01	15.40	188	1.00	1.00	.01	2906.
1.01	3.15	39	.01	0.00	.01	0.	1.01	15.45	189	.64	.63	.01	36151
1.01	3.20	40	.01	0.00	.01	0.	1.01	15.50	190	.55	.54	.01	2831.
1.01	3.25	41	.01	0.00	.01	0.	1.01	15.55	191	.36	.36	.01	2042.
1.01	3.30	42	.01	0.00	.01	0.	1.01	16.00	192	.36	.36	.01	1505.
1.01	3.35	43	.01	0.00	.01	0.	1.01	16.05	193	.28	.27	.01	1134.
1.01	3.40	44	.01	0.00	.01	0.	1.01	16.10	194	.28	.27	.01	921.
1.01	3.45	45	.01	0.00	.01	0.	1.01	16.15	195	.28	.27	.01	759.
1.01	3.50	46	.01	0.00	.01	0.	1.01	16.20	196	.28	.27	.01	665.
1.01	3.55	47	.01	0.00	.01	0.	1.01	16.25	197	.28	.27	.01	626.
1.01	4.00	48	.01	0.00	.01	0.	1.01	16.30	198	.28	.27	.01	611.
1.01	4.05	49	.01	0.00	.01	0.	1.01	16.35	199	.28	.27	.01	605.
1.01	4.10	50	.01	0.00	.01	0.	1.01	16.40	200	.28	.27	.01	602.
1.01	4.15	51	.01	0.00	.01	0.	1.01	16.45	201	.28	.27	.01	601.
1.01	4.20	52	.01	0.00	.01	0.	1.01	16.50	202	.28	.27	.01	601.
1.01	4.25	53	.01	0.00	.01	0.	1.01	16.55	203	.28	.27	.01	601.
1.01	4.30	54	.01	0.00	.01	0.	1.01	17.00	204	.28	.27	.01	601.
1.01	4.35	55	.01	0.00	.01	0.	1.01	17.05	205	.22	.21	.01	601.
1.01	4.40	56	.01	0.00	.01	0.	1.01	17.10	206	.22	.21	.01	575.
1.01	4.45	57	.01	0.00	.01	0.	1.01	17.15	207	.22	.21	.01	523.
1.01	4.50	58	.01	0.00	.01	0.	1.01	17.20	208	.22	.21	.01	490.
1.01	4.55	59	.01	0.00	.01	0.	1.01	17.25	209	.22	.21	.01	480.
1.01	5.00	60	.01	0.00	.01	0.	1.01	17.30	210	.22	.21	.01	474.
1.01	5.05	61	.01	0.00	.01	0.	1.01	17.35	211	.22	.21	.01	472.

1.01	5.10	62	.01	0.00	.01	0.
1.01	5.15	63	.01	0.00	.01	0.
1.01	5.20	64	.01	.00	.01	0.
1.01	5.25	65	.01	.01	.01	1.
1.01	5.30	66	.01	.01	.01	5.
1.01	5.35	67	.01	.01	.01	11.
1.01	5.40	68	.01	.01	.01	14.
1.01	5.45	69	.01	.01	.01	15.
1.01	5.50	70	.01	.01	.01	16.
1.01	5.55	71	.01	.01	.01	16.
1.01	6.00	72	.01	.01	.01	16.
1.01	6.05	73	.07	.06	.01	16.
1.01	6.10	74	.07	.06	.01	39.
1.01	6.15	75	.07	.06	.01	85.
1.01	6.20	76	.07	.06	.01	111.
1.01	6.25	77	.07	.06	.01	125.
1.01	6.30	78	.07	.06	.01	129.
1.01	6.35	79	.07	.06	.01	131.
1.01	6.40	80	.07	.06	.01	132.
1.01	6.45	81	.07	.06	.01	133.
1.01	6.50	82	.07	.06	.01	133.
1.01	6.55	83	.07	.06	.01	133.
1.01	7.00	84	.07	.06	.01	133.
1.01	7.05	85	.07	.06	.01	133.
1.01	7.10	86	.07	.06	.01	133.
1.01	7.15	87	.07	.06	.01	133.
1.01	7.20	88	.07	.06	.01	133.
1.01	7.25	89	.07	.06	.01	133.
1.01	7.30	90	.07	.06	.01	133.
1.01	7.35	91	.07	.06	.01	133.
1.01	7.40	92	.07	.06	.01	133.
1.01	7.45	93	.07	.06	.01	133.
1.01	7.50	94	.07	.06	.01	133.
1.01	7.55	95	.07	.06	.01	133.
1.01	8.00	96	.07	.06	.01	133.
1.01	8.05	97	.07	.06	.01	133.
1.01	8.10	98	.07	.06	.01	133.
1.01	8.15	99	.07	.06	.01	133.
1.01	8.20	100	.07	.06	.01	133.
1.01	8.25	101	.07	.06	.01	133.
1.01	8.30	102	.07	.06	.01	133.
1.01	8.35	103	.07	.06	.01	133.
1.01	8.40	104	.07	.06	.01	133.
1.01	8.45	105	.07	.06	.01	133.
1.01	8.50	106	.07	.06	.01	133.
1.01	8.55	107	.07	.06	.01	133.
1.01	9.00	108	.07	.06	.01	133.
1.01	9.05	109	.07	.06	.01	133.
1.01	9.10	110	.07	.06	.01	133.
1.01	9.15	111	.07	.06	.01	133.
1.01	9.20	112	.07	.06	.01	133.
1.01	9.25	113	.07	.06	.01	133.
1.01	9.30	114	.07	.06	.01	133.
1.01	9.35	115	.07	.06	.01	133.
1.01	9.40	116	.07	.06	.01	133.
1.01	9.45	117	.07	.06	.01	133.
1.01	9.50	118	.07	.06	.01	133.
1.01	9.55	119	.07	.06	.01	133.
1.01	10.00	120	.07	.06	.01	133.
1.01	10.05	121	.07	.06	.01	133.

1.01	17.40	212	.22	.21	.01	470.
1.01	17.45	213	.22	.21	.01	469.
1.01	17.50	214	.22	.21	.01	469.
1.01	17.55	215	.22	.21	.01	469.
1.01	18.00	216	.22	.21	.01	469.
1.01	18.05	217	.02	.01	.01	469.
1.01	18.10	218	.02	.01	.01	385.
1.01	18.15	219	.02	.01	.01	211.
1.01	18.20	220	.02	.01	.01	113.
1.01	18.25	221	.02	.01	.01	68.
1.01	18.30	222	.02	.01	.01	48.
1.01	18.35	223	.02	.01	.01	39.
1.01	18.40	224	.02	.01	.01	34.
1.01	18.45	225	.02	.01	.01	31.
1.01	18.50	226	.02	.01	.01	31.
1.01	18.55	227	.02	.01	.01	31.
1.01	19.00	228	.02	.01	.01	31.
1.01	19.05	229	.02	.01	.01	31.
1.01	19.10	230	.02	.01	.01	31.
1.01	19.15	231	.02	.01	.01	31.
1.01	19.20	232	.02	.01	.01	31.
1.01	19.25	233	.02	.01	.01	31.
1.01	19.30	234	.02	.01	.01	31.
1.01	19.35	235	.02	.01	.01	31.
1.01	19.40	236	.02	.01	.01	31.
1.01	19.45	237	.02	.01	.01	31.
1.01	19.50	238	.02	.01	.01	31.
1.01	19.55	239	.02	.01	.01	31.
1.01	20.00	240	.02	.01	.01	31.
1.01	20.05	241	.02	.01	.01	31.
1.01	20.10	242	.02	.01	.01	31.
1.01	20.15	243	.02	.01	.01	31.
1.01	20.20	244	.02	.01	.01	31.
1.01	20.25	245	.02	.01	.01	31.
1.01	20.30	246	.02	.01	.01	31.
1.01	20.35	247	.02	.01	.01	31.
1.01	20.40	248	.02	.01	.01	31.
1.01	20.45	249	.02	.01	.01	31.
1.01	20.50	250	.02	.01	.01	31.
1.01	20.55	251	.02	.01	.01	31.
1.01	21.00	252	.02	.01	.01	31.
1.01	21.05	253	.02	.01	.01	31.
1.01	21.10	254	.02	.01	.01	31.
1.01	21.15	255	.02	.01	.01	31.
1.01	21.20	256	.02	.01	.01	31.
1.01	21.25	257	.02	.01	.01	31.
1.01	21.30	258	.02	.01	.01	31.
1.01	21.35	259	.02	.01	.01	31.
1.01	21.40	260	.02	.01	.01	31.
1.01	21.45	261	.02	.01	.01	31.
1.01	21.50	262	.02	.01	.01	31.
1.01	21.55	263	.02	.01	.01	31.
1.01	22.00	264	.02	.01	.01	31.
1.01	22.05	265	.02	.01	.01	31.
1.01	22.10	266	.02	.01	.01	31.
1.01	22.15	267	.02	.01	.01	31.
1.01	22.20	268	.02	.01	.01	31.
1.01	22.25	269	.02	.01	.01	31.
1.01	22.30	270	.02	.01	.01	31.
1.01	22.35	271	.02	.01	.01	31.

1.01	10.10	122	.07	.06	.01	133.	1.01	22.40	272	.02	.01	.01	31.
1.01	10.15	123	.07	.06	.01	133.	1.01	22.45	273	.02	.01	.01	31.
1.01	10.20	124	.07	.06	.01	133.	1.01	22.50	274	.02	.01	.01	31.
1.01	10.25	125	.07	.06	.01	133.	1.01	22.55	275	.02	.01	.01	31.
1.01	10.30	126	.07	.06	.01	133.	1.01	23.00	276	.02	.01	.01	31.
1.01	10.35	127	.07	.06	.01	133.	1.01	23.05	277	.02	.01	.01	31.
1.01	10.40	128	.07	.06	.01	133.	1.01	23.10	278	.02	.01	.01	31.
1.01	10.45	129	.07	.06	.01	133.	1.01	23.15	279	.02	.01	.01	31.
1.01	10.50	130	.07	.06	.01	133.	1.01	23.20	280	.02	.01	.01	31.
1.01	10.55	131	.07	.06	.01	133.	1.01	23.25	281	.02	.01	.01	31.
1.01	11.00	132	.07	.06	.01	133.	1.01	23.30	282	.02	.01	.01	31.
1.01	11.05	133	.07	.06	.01	133.	1.01	23.35	283	.02	.01	.01	31.
1.01	11.10	134	.07	.06	.01	133.	1.01	23.40	284	.02	.01	.01	31.
1.01	11.15	135	.07	.06	.01	133.	1.01	23.45	285	.02	.01	.01	31.
1.01	11.20	136	.07	.06	.01	133.	1.01	23.50	286	.02	.01	.01	31.
1.01	11.25	137	.07	.06	.01	133.	1.01	23.55	287	.02	.01	.01	31.
1.01	11.30	138	.07	.06	.01	133.	1.02	0.00	288	.02	.01	.01	31.
1.01	11.35	139	.07	.06	.01	133.	1.02	.05	289	0.00	0.00	0.00	31.
1.01	11.40	140	.07	.06	.01	133.	1.02	.10	290	0.00	0.00	0.00	25.
1.01	11.45	141	.07	.06	.01	133.	1.02	.15	291	0.00	0.00	0.00	13.
1.01	11.50	142	.07	.06	.01	133.	1.02	.20	292	0.00	0.00	0.00	6.
1.01	11.55	143	.07	.06	.01	133.	1.02	.25	293	0.00	0.00	0.00	3.
1.01	12.00	144	.07	.06	.01	133.	1.02	.30	294	0.00	0.00	0.00	1.
1.01	12.05	145	.20	.19	.01	133.	1.02	.35	295	0.00	0.00	0.00	1.
1.01	12.10	146	.20	.19	.01	189.	1.02	.40	296	0.00	0.00	0.00	0.
1.01	12.15	147	.20	.19	.01	305.	1.02	.45	297	0.00	0.00	0.00	0.
1.01	12.20	148	.20	.19	.01	370.	1.02	.50	298	0.00	0.00	0.00	0.
1.01	12.25	149	.20	.19	.01	400.	1.02	.55	299	0.00	0.00	0.00	0.
1.01	12.30	150	.20	.19	.01	414.	1.02	1.00	300	0.00	0.00	0.00	0.
									SUM	31.20	29.04	2.16	63604.
										(792.)(	738.)(	55.)(	1801.06)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3615.	712.	221.	212.	63631.
CMS	102.	20.	6.	6.	1802.
INCHES		23.67	29.36	29.36	29.36
MM		601.11	745.76	745.76	745.76
AC-FT		353.	438.	438.	438.
THOUS CU M		436.	541.	541.	541.

HYDROGRAPH AT STA 4 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	5.	11.	14.	15.	16.
16.	16.	16.	39.	85.	111.	123.	129.	131.	132.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	189.	305.	370.	400.	414.
420.	423.	425.	425.	425.	425.	425.	442.	477.	497.

506.	510.	511.	512.	513.	513.	513.	513.	513.	538.
590.	620.	633.	639.	642.	643.	644.	645.	645.	645.
645.	595.	570.	570.	810.	1036.	1601.	2906.	3615.	2831.
2042.	1505.	1134.	921.	759.	665.	626.	611.	605.	602.
601.	601.	601.	601.	601.	575.	523.	494.	480.	474.
472.	470.	469.	469.	469.	469.	469.	385.	211.	113.
68.	48.	39.	34.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	25.
13.	6.	3.	1.	1.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3615.	712.	221.	212.	63631.
CMS	102.	20.	6.	6.	1802.
INCHES		23.67	29.36	29.36	29.36
MM		601.11	745.76	745.76	745.76
AC-FT		353.	438.	438.	438.
THOUS CU M		436.	541.	541.	541.

HYDROGRAPH AT STA 4 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	2.	5.	7.	8.	8.
8.	8.	8.	19.	43.	56.	62.	64.	66.	66.
67.	67.	67.	67.	67.	67.	67.	67.	67.	67.
67.	67.	67.	67.	67.	67.	67.	67.	67.	67.
67.	67.	67.	67.	67.	67.	67.	67.	67.	67.
67.	67.	67.	67.	67.	67.	67.	67.	67.	67.
67.	67.	67.	67.	67.	67.	67.	67.	67.	67.
67.	67.	67.	67.	67.	67.	67.	67.	67.	67.
67.	67.	67.	67.	67.	95.	153.	185.	200.	207.
210.	212.	213.	213.	213.	213.	213.	221.	238.	248.
253.	255.	256.	256.	256.	257.	257.	257.	257.	269.
295.	310.	317.	320.	321.	322.	322.	322.	322.	322.
322.	298.	285.	335.	405.	518.	800.	1453.	1807.	1415.
1021.	752.	567.	461.	379.	332.	313.	306.	302.	301.
300.	300.	300.	300.	300.	288.	262.	247.	240.	237.
236.	235.	235.	235.	235.	235.	235.	193.	106.	57.
34.	24.	20.	17.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	13.
6.	3.	1.	1.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1807.	356.	110.	106.	31815.
CMS	51.	10.	3.	3.	901.

PMF FLOOD ROUTING

INCHES	11.83	14.68	14.68	14.68
MM	300.56	372.88	372.88	372.88
AC-FT	177.	219.	219.	219.
THOUS CU M	218.	270.	270.	270.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH NEW LABELLE LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	1	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-690.	-1

STAGE	690.0	690.5	691.0	691.7	692.4	695.1	696.0	696.5	697.5	699.1
	700.5									
FLOW	0.	18.	50.	124.	206.	833.	1200.	2115.	6680.	16848.
	275.									
CAPACITY=	0.	152.	194.	211.	339.	489.	720.			
ELEVATION=	680.	688.	690.	691.	696.	700.	705.			

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
690.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
696.0	0.0	0.0	0.

STATION 8, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	2.	3.	4.	6.	8.	10.	12.
13.	15.	17.	20.	23.	26.	29.	31.	34.	37.
40.	42.	45.	47.	49.	52.	54.	56.	58.	60.
62.	64.	66.	67.	69.	71.	73.	74.	76.	77.
79.	80.	82.	83.	84.	86.	87.	88.	89.	91.
92.	93.	94.	95.	96.	97.	98.	99.	100.	101.
102.	102.	103.	104.	105.	106.	106.	107.	108.	108.
109.	110.	110.	111.	112.	113.	116.	122.	130.	139.

```
   147.    159.    164.    171.    179.    187.    194.    201.    212.    229.
   245.    261.    276.    290.    303.    315.    328.    339.    349.    360.
   372.    386.    401.    415.    428.    441.    454.    465.    476.    486.
   495.    503.    508.    514.    528.    552.    [illegible]    697.    866.   1120.
  1433.   1571.   1469.   1290.   1175.   1125.   1074.   1025.    980.    939.
   903.    870.    841.    823.    810.    797.    782.    765.    749.    732.
   717.    702.    688.    675.    662.    651.    640.    627.    607.    581.
   551.    522.    493.    465.    439.    415.    392.    370.    350.    331.
   313.    296.    280.    265.    251.    238.    225.    213.    204.    199.
   194.    189.    184.    179.    175.    171.    166.    162.    158.    154.
   151.    147.    141.    140.    137.    134.    130.    127.    125.    122.
   120.    117.    115.    113.    110.    108.    106.    104.    102.    100.
    99.     97.     95.     93.     92.     90.     88.     87.     85.     84.
    83.     81.     80.     79.     77.     76.     75.     74.     73.     71.
    70.     68.     67.     65.     63.     61.     60.     58.     57.     55.

                                         STORAGE
   194.    194.    194.    194.    194.    194.    194.    194.    194.    194.
   194.    194.    194.    194.    194.    194.    194.    194.    194.    194.
   194.    194.    194.    194.    194.    194.    194.    194.    194.    194.
   194.    194.    194.    194.    194.    194.    194.    194.    194.    194.
   194.    194.    194.    194.    194.    194.    194.    194.    194.    194.
   194.    194.    194.    194.    194.    194.    194.    194.    194.    194.
   194.    194.    194.    194.    194.    194.    194.    194.    194.    194.
   194.    195.    195.    195.    195.    196.    197.    197.    198.    199.
   200.    201.    202.    202.    203.    204.    205.    205.    206.    207.
   207.    208.    209.    209.    210.    210.    211.    211.    212.    213.
   213.    214.    214.    214.    215.    215.    216.    216.    217.    217.
   217.    218.    218.    218.    219.    219.    219.    220.    220.    220.
   221.    221.    221.    221.    222.    222.    222.    222.    223.    223.
   223.    223.    224.    224.    224.    224.    224.    225.    225.    225.
   225.    225.    225.    226.    226.    226.    227.    228.    230.    232.
   234.    236.    238.    239.    241.    243.    244.    246.    248.    250.
   251.    253.    255.    256.    258.    259.    261.    262.    263.    264.
   266.    267.    269.    270.    272.    273.    275.    276.    277.    278.
   279.    280.    281.    281.    283.    286.    291.    302.    319.    334.
   342.    344.    343.    340.    338.    334.    331.    328.    326.    323.
   321.    319.    317.    316.    314.    313.    311.    309.    307.    306.
   304.    302.    301.    299.    298.    297.    295.    294.    292.    289.
   286.    282.    279.    276.    273.    270.    268.    265.    263.    261.
   259.    257.    255.    254.    252.    251.    249.    248.    247.    246.
   244.    243.    242.    241.    240.    239.    238.    237.    236.    236.
   235.    234.    233.    232.    232.    231.    230.    230.    229.    228.
   228.    227.    227.    226.    225.    225.    224.    224.    223.    223.
   222.    222.    221.    221.    221.    220.    220.    219.    219.    219.
   218.    218.    216.    217.    217.    217.    216.    216.    216.    215.
   215.    215.    214.    214.    213.    213.    213.    212.    212.    211.

                                          STAGE
  690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0
  690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0
  690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0
  690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0
  690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0
  690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0
  690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0   690.0
  690.0   690.0   690.0   690.1   690.1   690.1   690.2   690.2   690.3   690.3
  690.4   690.4   690.5   690.5   690.6   690.6   690.7   690.7   690.8   690.8
  690.8   690.9   690.9   691.0   691.0   691.0   691.0   691.1   691.1   691.1
  691.1   691.1   691.2   691.2   691.2   691.2   691.2   691.2   691.3   691.3
```

691.3	691.3	691.3	691.3	691.3	691.4	691.4	691.4	691.4	691.4
691.4	691.4	691.4	691.4	691.5	691.5	691.5	691.5	691.5	691.5
691.5	691.5	691.5	691.5	691.5	691.5	691.6	691.6	691.6	691.6
691.6	691.6	691.6	691.6	691.6	691.6	691.7	691.7	691.8	691.9
691.9	692.0	692.1	692.1	692.2	692.3	692.3	692.4	692.5	692.5
692.6	692.7	692.7	692.8	692.9	692.9	693.0	693.0	693.1	693.1
693.2	693.2	693.3	693.3	693.4	693.5	693.5	693.6	693.6	693.6
693.7	693.7	693.7	693.8	693.8	693.9	694.1	694.0	694.2	694.8
694.1	694.2	694.1	694.0	694.9	694.8	694.7	694.6	694.5	694.4
694.3	694.2	694.2	694.1	694.0	694.0	694.9	694.8	694.8	694.7
694.6	694.6	694.5	694.5	694.4	694.4	694.3	694.3	694.2	694.1
693.9	693.8	693.7	693.6	693.4	693.3	693.2	693.1	693.1	693.0
692.9	692.8	692.8	692.7	692.6	692.6	692.5	692.5	692.4	692.4
692.3	692.3	692.3	692.2	692.2	692.1	692.1	692.1	692.0	692.0
692.0	691.9	691.9	691.9	691.8	691.8	691.8	691.8	691.7	691.7
691.7	691.7	691.6	691.6	691.6	691.6	691.6	691.5	691.5	691.5
691.5	691.5	691.4	691.4	691.4	691.4	691.4	691.4	691.3	691.3
691.3	691.3	691.3	691.3	691.3	691.3	691.2	691.2	691.2	691.2
691.2	691.2	691.2	691.1	691.1	691.1	691.1	691.1	691.1	691.1

PEAK OUTFLOW IS 1571. AT TIME 16.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1571.	831.	212.	204.	61117.
CMS	44.	18.	6.	6.	1731.
INCHES		20.37	28.20	28.20	28.20
MM		532.66	716.30	716.30	716.30
AC-FT		313.	421.	421.	421.
THOUS CU M		386.	519.	519.	519.

MAXIMUM STORAGE = 344.

AD-A104 783 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. NEW LA BELLE LAKE DAM (MO-10372), --ETC(U)
DEC 78 DACW43-78-C-0160

UNCLASSIFIED NL

2 OF 2
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A104783

END
DATE
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10-81
DTIC

ONE-HALF PMF FLOOD ROUTING

STATION 4, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	1.	1.	2.	3.	4.	5.	6.
7.	8.	9.	9.	10.	11.	12.	13.	14.	16.
15.	16.	17.	17.	18.	19.	21.	22.	23.	24.
25.	26.	27.	28.	29.	30.	31.	32.	33.	33.
34.	35.	36.	37.	37.	38.	39.	39.	40.	41.
41.	42.	43.	43.	44.	44.	45.	45.	46.	46.
47.	47.	48.	48.	49.	49.	49.	50.	50.	51.
51.	52.	52.	52.	53.	53.	55.	58.	62.	66.
70.	73.	77.	81.	84.	88.	91.	94.	98.	102.
106.	110.	114.	117.	121.	125.	129.	133.	136.	140.
145.	149.	154.	159.	164.	169.	174.	178.	183.	187.
191.	194.	197.	201.	206.	221.	249.	300.	380.	454.
500.	521.	532.	531.	524.	514.	502.	491.	480.	469.
459.	449.	440.	432.	424.	416.	408.	398.	389.	380.
371.	363.	356.	348.	341.	335.	329.	322.	312.	298.
283.	267.	253.	239.	225.	213.	203.	198.	192.	187.
182.	177.	172.	167.	162.	158.	154.	149.	145.	141.
138.	134.	130.	127.	123.	121.	118.	115.	112.	110.
107.	105.	102.	100.	98.	96.	94.	91.	89.	87.
86.	84.	82.	80.	78.	77.	75.	73.	72.	70.
69.	67.	66.	65.	63.	62.	61.	60.	59.	57.
56.	55.	54.	53.	52.	51.	50.	49.	49.	48.
47.	46.	45.	44.	43.	42.	41.	40.	39.	38.

STORAGE

194.	194.	194.	194.	194.	194.	194.	194.	194.	194.
194.	194.	194.	194.	194.	194.	194.	194.	194.	194.
194.	194.	194.	194.	194.	194.	194.	194.	194.	194.
194.	194.	194.	194.	194.	194.	194.	194.	194.	194.
194.	194.	194.	194.	194.	194.	194.	194.	194.	194.
194.	194.	194.	194.	194.	194.	194.	194.	194.	194.
194.	194.	194.	194.	194.	194.	194.	194.	194.	194.
194.	194.	194.	194.	195.	195.	195.	196.	196.	197.
197.	197.	198.	198.	199.	199.	199.	200.	200.	200.
201.	201.	201.	202.	202.	202.	203.	203.	203.	203.
204.	204.	204.	205.	205.	205.	205.	205.	206.	206.
206.	206.	206.	207.	207.	207.	207.	207.	208.	208.
208.	208.	208.	208.	208.	209.	209.	209.	209.	209.
209.	209.	209.	210.	210.	210.	210.	210.	210.	210.
210.	210.	210.	211.	211.	211.	211.	212.	213.	214.
215.	216.	217.	218.	219.	220.	220.	221.	222.	223.
224.	225.	226.	227.	228.	229.	230.	231.	232.	232.
233.	235.	236.	237.	238.	239.	240.	241.	242.	243.
244.	245.	245.	246.	247.	249.	252.	258.	267.	275.
280.	282.	283.	283.	282.	281.	280.	279.	278.	276.
275.	274.	273.	272.	271.	271.	270.	269.	267.	266.

```
          266.      265.      264.      263.      262.      261.      261.      260.      259.      257.
          256.      254.      252.      251.      249.      248.      247.      245.      244.      243.
          242.      241.      239.      238.      237.      236.      235.      234.      234.      233.
          232.      231.      230.      229.      229.      228.      227.      227.      226.      225.
          225.      224.      223.      223.      222.      222.      221.      221.      220.      220.
          219.      219.      218.      218.      217.      217.      216.      216.      216.      215.
          215.      214.      214.      214.      213.      213.      213.      212.      212.      212.
          212.      211.      211.      211.      211.      210.      210.      210.      210.      209.
          209.      209.      209.      208.      208.      208.      208.      207.      207.      207.

                                                  STAGE
          690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0
          690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0
          690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0
          690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0
          690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0
          690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0
          690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0     690.0
          690.0     690.0     690.0     690.0     690.0     690.1     690.1     690.1     690.1     690.2
          690.2     690.2     690.2     690.3     690.3     690.3     690.3     690.4     690.4     690.4
          690.4     690.4     690.5     690.5     690.5     690.5     690.5     690.6     690.6     690.6
          690.6     690.6     690.6     690.7     690.7     690.7     690.7     690.7     690.7     690.7
          690.8     690.8     690.8     690.8     690.8     690.8     690.8     690.8     690.8     690.9
          690.9     690.9     690.9     690.9     690.9     690.9     690.9     690.9     690.9     690.9
          690.9     691.0     691.0     691.0     691.0     691.0     691.0     691.0     691.0     691.0
          691.0     691.0     691.0     691.0     691.0     691.0     691.1     691.1     691.1     691.2
          691.2     691.2     691.3     691.3     691.3     691.4     691.4     691.4     691.5     691.5
          691.5     691.6     691.6     691.7     691.7     691.7     691.8     691.8     691.8     691.9
          691.9     691.9     692.0     692.0     692.1     692.1     692.2     692.2     692.2     692.3
          692.3     692.3     692.4     692.4     692.4     692.5     692.6     692.8     693.2     693.5
          693.7     693.8     693.8     693.8     693.8     693.8     693.7     693.7     693.6     693.6
          693.5     693.5     693.4     693.4     693.4     693.3     693.3     693.3     693.2     693.2
          693.2     693.1     693.1     693.1     693.0     693.0     693.0     692.9     692.9     692.8
          692.8     692.7     692.6     692.6     692.5     692.5     692.4     692.4     692.3     692.3
          692.2     692.2     692.1     692.1     692.1     692.0     692.0     691.9     691.9     691.9
          691.8     691.8     691.8     691.8     691.7     691.7     691.7     691.6     691.6     691.6
          691.6     691.5     691.5     691.5     691.5     691.5     691.4     691.4     691.4     691.4
          691.4     691.3     691.3     691.3     691.3     691.3     691.2     691.2     691.2     691.2
          691.2     691.2     691.2     691.1     691.1     691.1     691.1     691.1     691.1     691.1
          691.1     691.1     691.0     691.0     691.0     691.0     691.0     691.0     691.0     691.0
          691.0     690.9     690.9     690.9     690.9     690.9     690.9     690.8     690.8     690.8

PEAK OUTFLOW IS      532. AT TIME  16.08 HOURS

                                   PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                          CFS      532.      292.      104.       99.         29844.
                          CMS       15.        8.        3.        3.           845.
                       INCHES                9.71     13.77     13.77          13.77
                           MM              246.54    349.78    349.78         349.78
                        AC-FT                145.      206.      206.           206.
                    THOUS CU M               179.      254.      254.           254.

                                       MAXIMUM STORAGE =      283.
```

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	4	.28 (.73)	1	3615. (102.35)	1807. (51.18)
ROUTED TO	4	.28 (.73)	1	1571. (44.49)	552. (15.06)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	690.00	690.00	696.00
STORAGE	194.	194.	339.
OUTFLOW	0.	0.	1200.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	696.18	.18	364.	1571.	.53	16.00	0.00
.50	693.[illegible]	0.00	285.	532.	0.00	16.00	0.00

```
*****************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  5 AUG 78
*****************************
```

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  3 AUG 78
**********************************

RUN  DATE* 78/11/22.
     TIME* 13.49.14.

                              DAM SAFETY INSPECTION - MISSOURI
                                   NE  LABELLE LAKE DAM
                            PERCENT OF PMF DETERMINATION AND ROUTING

                                        JOB SPECIFICATION
           NQ      NHR      NMIN     IDAY      IHR      IMIN    METRC     IPLT     IPRT    NSTAN
          300        0         5        0        0         0        0        0        4        0
                                       JOPER      NWT     LROPT    TRACE
                                           5        0         0        0

                                  MULTI-PLAN ANALYSES TO BE PERFORMED
                                     NPLAN= 1 NRTIO= 9 LRTIO= 1
              RTIOS=    .91     .92     .93     .94     .95     .96     .97     .98     .99

    **********         **********         **********         **********         **********

                                    SUB-AREA RUNOFF COMPUTATION

                INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UH
                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE  IAUTO
                              4       0       0       0       0       0       1       0       0

                                          HYDROGRAPH DATA
               IHYDG    IUHG    TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                   1      -1      .28    0.00     .28    1.00   0.000       0       0       0

                                            PRECIP DATA
                         SPFE     PMS      R6     R12     R24     R48     R72     R96
                         0.00   24.00  100.00  120.00  130.00    0.00    0.00    0.00

                                             LOSS DATA
         LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
             0    0.00    0.00    1.00    0.00    0.00    1.00     .85     .07    0.00    0.00

                                          RECESSION DATA
                        STRTQ=    0.00     QRCSN=    0.00     RTIOR= 1.00

                                        END-OF-PERIOD FLOW
      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                             SUM   31.20  29.00   2.10   83604.
                                                                                 ( 792.)( 736.)( [illegible])( [illegible])
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********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH NEW LABELLE LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-690.	-1

STAGE	690.0	690.5	691.0	691.7	692.4	695.1	696.0	696.5	697.5	699.1	700.5
FLOW	0.	18.	50.	124.	206.	833.	1200.	2115.	6680.	16884.	27523.
CAPACITY=	0.	152.	194.	219.	339.	449.	724.				
ELEVATION=	660.	688.	690.	691.	696.	700.	705.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
690.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
696.0	0.0	0.0	0.

PEAK OUTFLOW IS 1153. AT TIME 16.08 HOURS

PEAK OUTFLOW IS 1171. AT TIME 16.08 HOURS

PEAK OUTFLOW IS 1190. AT TIME 16.08 HOURS

PEAK OUTFLOW IS 1286. AT TIME 16.08 HOURS

PEAK OUTFLOW IS 1249. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 1360. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 1425. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 1474. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 1523. AT TIME 16.00 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .91	RATIO 2 .92	RATIO 3 .93	RATIO 4 .94	RATIO 5 .95	RATIO 6 .96	RATIO 7 .97	RATIO 8 .98	RATIO 9 .99
HYDROGRAPH AT	4	.28 (.73)	1	3289. (93.14)	3325. (94.16)	3362. (95.19)	3398. (96.21)	3434. (97.24)	3470. (98.26)	3506. (99.28)	3542. (100.31)	3578. (101.33)
ROUTED TO	4	.28 (.73)	1	1153. (32.65)	1171. (33.17)	1190. (33.69)	1208. (34.23)	1269. (35.94)	1360. (38.51)	1425. (40.34)	1474. (41.75)	1523. (43.12)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1.....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	690.00	690.00	696.00
STORAGE	194.	194.	339.
OUTFLOW	0.	0.	1200.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.91	695.89	0.00	336.	1153.	0.00	16.08	0.00
.92	695.93	0.00	337.	1171.	0.00	16.08	0.00
.93	695.98	0.00	338.	1190.	0.00	16.08	0.00
.94	696.01	.01	339.	1226.	.17	16.08	0.00
.95	696.04	.04	340.	1289.	.17	16.00	0.00
.96	696.08	.08	341.	1360.	.17	16.00	0.00
.97	696.11	.11	342.	1425.	.33	16.00	0.00
.98	696.13	.13	343.	1474.	.33	16.00	0.00
.99	696.16	.16	343.	1523.	.33	16.00	0.00

LME